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Strikes Curtail Production

Chrysler Stoppage Cuts 5000 Units Daily From Industry's December Schedules of Half-Million

By Harold E. Gronseth

Labor troubles in the automotive parts industry are certain to affect previous estimates of December automobile production. The car factories had about reached top speed in operations at the start of the month and indications were that output would set an all-time December record, approaching the 500,000 unit mark, but just as the industry got into full swing, the flow of parts for suppliers was interrupted by strikes.

Assembly operations were suspended by the four Chrysler divisions Wednesday morning because of shortage of frames caused by the strike at the Midland Products plant in Detroit. Approximately 4800 units will be dropped from the current month's output for every day these assembly lines failed to operate. Some curtailment took place before the actual suspension, and when production is resumed there will be a lag before full production is again attained. The nine-day closing of the Bendix plant on account of the strike late last month did not materially affect automobile producion because the parts supplied by this plant are small

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This Week

Joseph Geschelin spent considerable time at the Pontiac plant recently and what has been accomplished there during their three-year program makes a noteworthy story. It begins on page 768.

On page 784 there are some more mechanical specifications of 1937 passenger cars while the next two pages show the details of the new Buick engine and transmission.

The French Aviation Show brought to the front a number of power plant improvements marking the two years that have elapsed since the last show as years of distinct progress. You will find the whole interesting story as W. F. Bradley sees it if you will turn to page 788.

Guests Honor Diesel

Remarkable Advance of His Invention Described by Industrialists

Achievements of Diesel power were summarized by leaders of the industry, congratulations were showered on the Diesel industry by leaders of the industries at a luncheon held in New York Dec. 2, celebrating the 40th anniversary of the introduction of Diesel power in the United States.

As master of ceremonies, John B. Kennedy, radio commentator, delivered a "journalistic appraisal" of the industry and introduced the speakers, several of whom brought out some little known facts about Rudolf Diesel and his invention.

Edward B. Pollister, president of Busch-Sulzer Brothers Diesel Engine Co., recalled that Adolphus Busch purchased American rights to the Diesel engine in 1896, and that Rudolf Diesel had been technical adviser and a director and stockholder of his company.

Col. Robert H. Morse, president, Fairbanks-Morse & Co., recalled the work of his father in pioneering internal combustion engines in the United States.

B. C. Heacock, president, Caterpillar Tractor Co., recalling that the first Diesel-powered tractor was delivered by his company on Oct. 20, 1931, announced the delivery of nearly 22,000 by his company to date.

Other speakers were: Charles F. Kettering, vice-president, General Motors Corp.; David S. Sarnoff, president, Radio Corporation of America;

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Scientific American photo

The late Dr. Rudolf Diesel, Paris-born Bavarian who created the Diesel principle of combustion, was honored by a luncheon in New York Dec. 2, the 40th anniversary of the introduction of Diesel power into the U. S.

Strike Halts Chrysler

Midland Steel Strike Stops Supply of Frames

A shortage of chassis frames due to a strike at the Midland Steel Products Co.'s plant in Detroit resulted in the stoppage of the four Chrysler assembly lines Dec. 2. Operations would be resumed as soon as frames became available, it was stated by K. T. Keller, president of Chrysler Corp. Other manufacturing operations being carried on in the Chrysler plants have not yet been affected.

The Midland strike started Nov. 27 and was called during negotiations for a wage increase. Some 1200 men of the day shift staged the sitdown and occupied the plant. A. L. Faulkner, Federal Labor Conciliator, arrived early in the week from Cleveland and began efforts to settle the difference. In addition to Faulkner, Wyndham Mortimer, first vice-president of the United Automobile Workers; Edward

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UAW Fails to Get Closed Shop

Bendix Settlement Ignores Original Demand; Union Recognized as Bargaining Agent

If the goal of the United Automobile Workers International Union in the Bendix strike was the institution of a closed shop, no gains toward that end were made in the settlement. Union officials, however, now maintain that the closed shop was never officially an issue. Workers in certain departments had stated that this was the aim of the sitdown which started in a department where all but six of the 296 employes were union members. Unionists complained of favoritism being shown by the management toward the six non-union men who were members of the Bendix Employes Association, and finally refused to work with them unless they joined the UAW.

The complete text of the settlement reached between Bendix executives and UAW officials follows:

1. The company shall cooperate with local union No. 9 by agreeing to take back all of the employes on the employment roll as of Nov. 16, 1936, without discrimination or loss of seniority rights, as far as practicable, to the extent that there are jobs for them.

2. All employes shall be back at work in their former places not later than Monday morning, Nov. 30, 1936.

3. The company is recognizing local union No. 9 as the bargaining agent for its membership, and all other employes who shall choose to avail themselves of its services, on all matters pertaining to their working conditions. The company shall negotiate with the committee of local union No. 9 on request on all matters with respect to rates of pay, wages, hours of employment, or other conditions of employment, and shall not finally agree with any other group with respect to such matters without also having reached an agreement on the same matters with the representatives of local union No. 9. The company shall continue to recognize individuals' rights.

4. There shall be established a board of review to which any member of the union or any other employe who secures the consent of the executive board of local union No. 9, who is dissatisfied with the decision of the personnel director, may take his complaint or grievance. This board shall be composed of three members of local union No. 9 who are not concerned with the presenting of complaints and three members of the executive staff of the company not connected with the shop management. The management of local union No. 9 shall nominate six persons for the committee from which local union No. 9 shall choose three. Any employe whose case is being considered by the board shall have the right to be represented by one or more members of the executive board of local union No. 9.

5. Men laid off by reason of reduction of forces shall be given at least one day's notice in advance of such lay-off.

6. Employes notified to report for work when no work is available shall be provided with a minimum of two hours' employment instead of one hour as in the past.

7. In order to carry out the spirit and intent of this agreement, the management agrees that it will cooperate with local union No. 9 in jointly considering all proposals which may be submitted by local union No. 9 to the management after resumption of work.

Wants Federal Control

Borah Pronounces for National Licensing of Corporations

Returning to Washington Dec. 2, Senator William E. Borah, of Idaho, announced that he would support the O'Mahoney bill which would make Federal incorporation of business corporations compulsory. Borah indicated that his interest in the legislation lay in the possibilities of curbing monopolies rather than in revival of the NRA. Such legislation as he had in mind, Borah stated, would bring the Ford Motor Co. under regulation by the United States government.

At the last session Borah introduced

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Walsh-Healey Evasions Checked

Additional Regulations Prevent Dealers from Selling Goods Produced in Non-Complying Plants

Secretary of Labor Perkins has promulgated an additional regulation to prevent dealers from evading the provisions of the Walsh-Healey Act by selling goods to the government produced in plants which are not complying with the labor standards of the law. Under the regulation the manufacturer as well as the dealer who contracts with the government is made amenable to the act.

The regulation reads as follows.

"Whenever a dealer, to whom a contract within the act and regulations has been awarded, causes a manufacturer to deliver directly to the government the materials, supplies, articles or equipment required under the contract, such dealer will be deemed the agent of the manufacturer in executing the contract. As the principal of such agent the manufacturer will be deemed to have agreed to the stipulations contained in the contract."

Miss Perkins said the effect of the regulation is not to eliminate dealers from bidding on government contracts

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Underwood & Underwood photo

Fire destroyed Nov. 30 the Crystal Palace, a London landmark famous since its construction in 1854. London's automobile shows were held in the Palace for many years, beginning in the 1890's when the first "horseless vehicles" were exhibited in the annual bicycle shows.

RAY D. PEO, who has been with the Autocar Co. since 1922, has been promoted to the position of vice-president of the company. Following 27 months' overseas service during the war he joined the Autocar Co. as salesman at the Cleveland branch and was later promoted to the managership of the Toledo branch. Following this he was made manager of the larger branch in Columbus, and since 1930 he has been district manager, making his headquarters in Cleveland.

B. C. HEACOCK, president of the Caterpillar Tractor Co., of Peoria, Ill., has been nominated for president of the Illinois Manufacturers Association.

H. H. ERKELENZ has been made manager of engineering and works with the Harnishfeger Corp., Milwaukee. He has been with the company for 25 years.

HARRY SCHNEIDER, JR., was recently appointed eastern representative to cover the New England, Eastern New York and Atlantic Coast territory of the Timken-

Detroit Axle Co. Mr. Schneider has been associated with the automotive industry in various capacities for the past 20 years.

R. M. W. SHAW, assistant sales manager of the Olds Motor Works, left Lansing last week with Mrs. Shaw for a month's vacation trip to Europe.

HERMAN MENCK, who has been with the Harnishfeger Corp., Milwaukee, for the past year and a half, has been advanced to works manager. He was formerly works manager of the Waukesha Motor Co.

5 Big Races for U. S.

International Board Allots Dates for 1937 Major Contests

Five major automobile races have been allotted the United States in the international calendar of important speed contests drawn up by the International Association of Recognized Automobile Clubs. The international group, of which the Contest Board of the American Automobile Association is a member, controls automobile racing and speed trials in all the important nations of the world.

The five important events allowed this country are the 500-Mile International Sweepstakes at the Los Angeles Raceway, March 28; the 500-Mile International Sweepstakes at the Indianapolis Speedway, May 31; the Pan-American Cup Race at Roosevelt Raceway, Westbury, L. I., July 5; the 400-Mile George Vanderbilt Cup Sweepstakes at Roosevelt Raceway, Sept. 6; and the 500-Mile International Sweepstakes—second of the year—at the Los Angeles Speedway, Nov. 28.

Acme photo

"Seldom has London witnessed such a turnout as gathered on Nov. 14 around the Hotel Metropole . . . to do honor to the motor vehicle," wrote *The Horseless Age* 40 years ago. On that day the law that required a man with a red flag to precede all mechanically propelled road vehicles was finally repealed and for the first time the English were able to enjoy the automobiles that had already become common sights in U. S. and French cities. The photograph above shows celebration in London last month of the 40th anniversary of the "emancipation of the motor car." Nearly 100 old cars—all built before 1905—took part in the procession over Westminster Bridge.

Strikes Spread in Glass Plants

Sympathetic Sitdown Staged at Libby Plant Which Received Chrysler Order After 6 Weeks' Deadlock at Pittsburgh

A strike of flat glass workers which began at the Pittsburgh Plate Glass Co.'s plant in Pittsburgh Oct. 24 spread this week to glass companies in other parts of the country and became a serious menace to a continuation of the present high rate of production in automobile factories.

The contract which the glass workers' union had with Pittsburgh was to have expired Nov. 1, 1936, but at a conference which began Oct. 16 union officials stated that unless the company would agree to a closed shop, or a preferential union shop with the check-off, further negotiations would be useless. The company had, in the previous contract, agreed to recognize the union only to the extent of its membership. So far there is no indication that the company will accede to the union's demands. Federal conciliators have been working with the disputants in Pittsburgh but without favorable results up to the present time.

The Pittsburgh Plate Glass Co. has been supplying Chrysler, Nash and Hudson. A few days ago it was announced that Libby-Owens-Ford Glass Co. had received a contract for $1,500,000 worth of glass from Chrysler to be completed in 30 weeks in its Ottawa, Ill., plant. Work on this order started Nov. 30 and the following day 75 pattern cutters staged a sitdown strike at the plant on the order of Glen McCabe, president of the Federation of Flat Glass Workers. As a consequence, the Ottawa plant was completely shut down a day later. A few weeks ago the union had given McCabe authority to take whatever steps seemed necessary to prevent Libby-Owens-Ford from defeating the purpose of the Pittsburgh strike.

About 60 per cent of the laminated glass used in automobiles is made by the Libby-Owens-Ford company in its various plants. This company supplies all of General Motors units and Graham. The Ford Motor Co. makes its own glass, although recently it has been purchasing laminated glass from the Crystal, Mo., plant of the Pittsburgh Plate Glass Co. This plant is unorganized.

There has been no trouble at the Libby-Owens-Ford Toledo plant where production of glass for General Motors went on normally. Labor contracts at this plant expire Dec. 15 and negotiations for renewal will begin some time before that date.

FTC Attacks "6 Per Cent" Claims

21 Automobile and Finance Companies Are Cited for "False and Misleading Representations"

False and misleading representations as to the amount of interest charged purchasers of automobiles under deferred payment plans are alleged in eight complaints issued Dec. 3 by the Federal Trade Commission, charging violation of Sec. 5 of the Federal Trade Commission Act, which forbids unfair competition in commerce.

The eight complaints name 21 respondents, including both automobile companies and automobile financing companies. In addition to the automobile manufacturing companies, the list of respondents includes the General Motors Corp. and the sales corporation of the Chrysler group. Respondent automobile companies are:

The Nash Motors Co., Kenosha, Wis.; General Motors Corp., Detroit, and its subsidiaries which produce Chevrolet, Olds, Pontiac, Buick and Cadillac cars; Chrysler Corp., Detroit, and its subsidiaries, Chrysler Sales Corp., and those manufacturing De Soto, Dodge and Plymouth cars; Graham-Paige Motors Corp., Detroit; Hudson Motor Car Co., Detroit; Ford Motor Co., Dearborn, Mich.; Reo Motor Car Co., Lansing,

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Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for AUTOMOTIVE INDUSTRIES

There was no decline in general business activity last week, and it appears that trade will be well maintained during the remainder of the year. Consumer spending has been heavy since the election, and many merchants are looking forward to a large volume of Christmas buying. Retail trade last week is estimated from 15 to 25 per cent above that in the corresponding period last year, while wholesale business showed a gain from 22 to 25 per cent.

Guaranty Index at 91

The Guaranty Trust Co.'s index of business activity for October stands at the preliminary figure of 91.0, as against 88.2 the month before and 77.2 a year ago. The company's index of wholesale commodity prices on Nov. 15 stood at 62.1, as against 59.0 a month earlier and 55.1 a year earlier.

Carloading Hold Gains

Railway freight loadings during the week ended Nov. 21 amounted to 789,500 cars, which marks an increase of 4828 cars above those in the preceding week, a gain of 141,576 cars above those a year ago, and a rise of 227,580 cars above those two years ago.

Life Insurance Business Down

Sales of ordinary life insurance in the United States during the month of October were two per cent below those in the corresponding period last year. Sales during the first 10 months of this year were four per cent below those a year ago.

Power Output Rising

Production of electricity by the electric light and power industry in the United States during the week ended Nov. 21 was slightly above that in the preceding week and was 12.4 per cent above that in the corresponding period last year.

Strike Handicaps Lumber

Production of lumber during the week ended Nov. 14 was 55 per cent of the 1929 weekly average. New orders were above production. The maritime strike continues to retard output and shipments.

Fisher's Index

Professor Fisher's index of wholesale commodity prices for the week ended Nov. 28 stood at 86.0, as against 86.1 the week before and 85.3 two weeks before.

Federal Reserve Statement

The consolidated statement of the Federal Reserve banks for the week ended Nov. 25 showed an increase of $1,000,000 in holdings of discounted bills. Holdings of bills bought in the open market and of government securities remained unchanged. The monetary gold stock increased $35,000,000, and money circulation rose $54,000,000.

Manchukuo must have an automobile industry of her own, says Yosuke Matsuoka, president of the South Manchuria Railway Co. Mr. Matsuoka, as Japanese delegate to the League of Nations, staged the famous walk-out of his country from the Geneva organization.

Wants Motor Plants

Matsuoka Says Manchukuo Needs Factories for Defense

Yosuke Matsuoka, president of the South Manchuria Railway Co., who recently returned to his post after a brief visit in Japan, in an interview in Tokyo stressed the rapid militarization of Soviet Russia in the Far East and expressed his belief that immediate consideration should be given to augmenting the defenses of Manchukuo, Korea and Japan.

"In this connection it may become imperative to establish automobile and aircraft industries in Manchukuo in the future," said Mr. Matsuoka. "During my sojourn in Japan, I have had a chance to inspect the automobile manufacturing and assembling plants of the Nissan Automobile Co. at Yokohama and the Toyoda factory at Nagoya. It is still doubtful, however, whether it is possible to transplant Japan's automobile industry into Manchukuo at present. The motor-car industry in Japan has just been started and is still in its infancy," he continued.

"It may thus be more expedient for Manchukuo to create her own automobile industry by inviting experts from the United States, France and Germany, following the steps taken by Soviet Russia," he added.

Mr. Matsuoka, as head of the Japanese owned railway, is one of the outstanding figures in the economic life of Manchukuo.

A law designated to regulate the industrial activities of Manchukuo, to provide better protection for key industries and to strengthen the Japan-Manchukuo economic bloc, will be promulgated by the Manchukuo government late in December or early in January next year.

The most salient feature of this law is a clear-cut definition of the words "free" and "controlled" as applied to industrial enterprises. Strict secrecy is being observed about the industries which will come under the new law, but according to sources close to government circles, such industries as the automobile, iron, steel and other metals, galvanized and metallic plates manufactures will be affected.

The system of "one corporation for one industry" will be adopted as the guiding principle of the law so that it may be under perfect control and managed along national lines. Priority will be given to those firms already operating.

The Manchukuo automobile industry, as an enterprise closely related to the Japanese motor industry, will be regulated so that "cooperation can be maintained in line with the economic collaboration between the two Empires," as the *Manchuria Fortnightly* puts it. Selling prices will also be regulated.

40 Years Ago

with the ancestors of AUTOMOTIVE INDUSTRIES

The George N. Pierce Co. has been organized at Buffalo, N. Y., to manufacture bicycles and road vehicles. The capital is $280,000.

The Duryea Motor Wagon Co. have received from the motor car club of London a gold medal in recognition of their splendid performance in the London-Brighton tour on Nov. 14.

The Pope Manufacturing Co. expect to make an announcement in regard to motor carriages at the New York Cycle Show in February.

Herbert C. Baker of Hartford, Conn., has entered into arrangements with English capitalists to found a motor carriage business at Manchester, Conn. The plant formerly occupied by the Mather Electric Co. has been secured and a force of men are now at work on the first model of the Baker motor carriage which, it is hoped, will be completed within three months.

—From *The Horseless Age*, December, 1896.

2 Firms Pay Extras

Evans Products, Houdaille-Hershey Declare Special Dividends

Evans Products Co. has declared a regular dividend of 25 cents per share, payable Dec. 15 to stockholders of record Dec. 4. This dividend will take the place of the regular disbursement which would be payable Jan. 1, 1937. The board also declared a special dividend of 50 cents per share, payable on Dec. 15 to stockholders of record Dec. 4. This extra payment brings the total of dividends for 1936 to $1.75 per share as compared to a total of $1.00 in 1935.

In commenting on the action of the board, E. S. Evans, president, said: "With earnings running substantially ahead of 1935, we feel that this extra payment to stockholders is entirely merited."

The directors of Houdaille-Hershey Corp. have declared a dividend of 75 cents per share on the Class B no par value stock, payable Dec. 15, 1936, to stockholders of record at the close of business Dec. 5, 1936. The dividend so declared represents the regular quarterly dividend of 37½ cents per share together with an extra dividend of 37½ cents per share. After making the above payment, total dividends paid on the Class B stock this year will amount to $2.87½ per share.

The directors have also declared the regular quarterly dividend of 62½

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Howard S. Welch Named Head of Bendix Exports

Howard S. Welch, formerly president of the Studebaker-Pierce Arrow Export Corp. and since 1935 chief of the automotive and aeronautic division of the Department of Commerce, Washington, has been named by the Bendix Aviation Corp. to head up its export organization.

To the widely diversified line of automotive and aviation equipment manufactured by the various divisions of Bendix, Mr. Welch brings a long experience in the automobile and aircraft business. After several years of export work in the automobile equipment line prior to the war, Welch joined the air service of the U. S. Army and served in France in various capacities with the chief of air service, first army. Returning in 1919, he joined the Studebaker Corp. where he remained 13 years and became president of its export corporation. In this capacity he managed the foreign dealer organization and subsidiary operations of the eight Studebaker branches abroad.

Commenting upon Welch's association with the Bendix Aviation Corp., Vincent Bendix said that the various products manufactured by the several divisions of its subsidiaries, are finding an increasing market abroad. Welch, whose headquarters will be in New York, will be responsible for foreign sales of the Bendix subsidiaries manufacturing products in the automotive, aviation, marine and industrial divisions.

Howard S. Welch
who will head Bendix exports

Automotive Metal Markets

Heavy Commitments of Steel Insure Deliveries at Present Prices Well Into the Coming Year

By William Crawford Hirsch

Activity in the steel market consists chiefly of the placing of those orders, supposedly for delivery before the end of the year, which mills are willing to accept at the old prices. A good deal of guessing is being indulged in as to how much old price steel automobile manufacturers and parts makers will have by way of a nest-egg against their early 1937 needs. Conditions differ in the various steel products, but it is certain that an impressive part of the actual movement of steel to consumers in January will consist of belated old price shipments. Steel producers, of course, are anxious to have the higher 1937 prices show in their billing as speedily as possible, but most are agreed that the second quarter of 1937 will be drawing near before they can hope to receive the full benefit of higher prices.

Fourth quarter commitments have been running extraordinarily heavy and few instances of attractive orders being turned down because of the time limit have come to light, so that a good deal of business may be expected to come in for shipment at mills' convenience following the turn of the year.

No definite announcement with reference to the new price for cold rolled strip steel has so far come through, the general expectation being that the same advance as that noted for hot rolled strips, $4 a net ton, will apply, although here and there predictions of a sharper advance in the cold rolled have been made. Cold finished steel bars have been advanced $4 a net ton in response to the $3 a ton advance in the price of hot rolled bars. The cost of conversion is enhanced beyond the extent of the rise in price of the hot rolled material by the proportionately higher scrap cost.

There is some talk of a further advance in the price of manufacturing

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Calendar of Coming Events

SHOWS

28th Automobile Salon, Brussels, Belgium .....Nov. 28-Dec. 9
First International Consumers Petroleum Exposition, Convention Hall, Detroit .....Dec. 5-13
Automotive Service Industries Joint Show, Chicago .....Dec. 9-13
National Motor Boat Show, New York, Jan. 8-16
Illinois Automotive Ass'n, 4th Annual Show and Maintenance Exhibit, Navy Pier, Chicago.....Apr. 24-28, 1937

CONVENTIONS AND MEETINGS

Motor & Equipment Wholesalers Assn., Annual Convention, Chicago ..Dec. 7-8
National Automotive Parts Assn., Annual Convention, Chicago .....Dec. 7-8
National Standard Parts Association, Annual Convention, Chicago...Dec. 7-8
Motor & Equipment Mfrs. Assn., Annual Meeting, Chicago .....Dec. 10
Tin Can Tourists' Homecoming, Arcadia, Fla. ....Dec. 28, 1936-Jan. 3, 1937
S.A.E. Annual Meeting, Detroit, Mich., Jan. 11-15, 1937
American Road Builders Association, Highway Exhibit and Convention, New Orleans .....Jan. 11-15
Tin Can Tourists' Winter Convention, Clearwater, Fla. ....Jan. 29-Feb. 8, 1937
Tin Can Tourists' Winter Convention, Sarasota, Fla. .....Feb. 8-14, 1937
International Association for Testing Materials, Second International Congress, London, England, April 19-24, 1937
American Society for Testing Materials, 937 Regional Meeting and Committee Week, Palmer House, Chicago, March 1-5
41st Annual Convention and Exposition of the American Foundrymen's Association, Milwaukee, beginning May 2, 1937
American Petroleum Institute, Mid-Year Meeting, Colorado Springs, Col. .....June 1-3

CONTESTS

Los Angeles Raceway, 500-Mile International Sweepstakes .....March 28
Indianapolis Speedway, 500-Mile International Sweepstakes .....May 31
Pan American Cup Race, Roosevelt Raceway .....July 5
Roosevelt Raceway, 400-Mile George Vanderbilt Cup Sweepstakes....Sept. 6
Los Angeles, 2nd 500-Mile International Sweepstakes .....Nov. 28

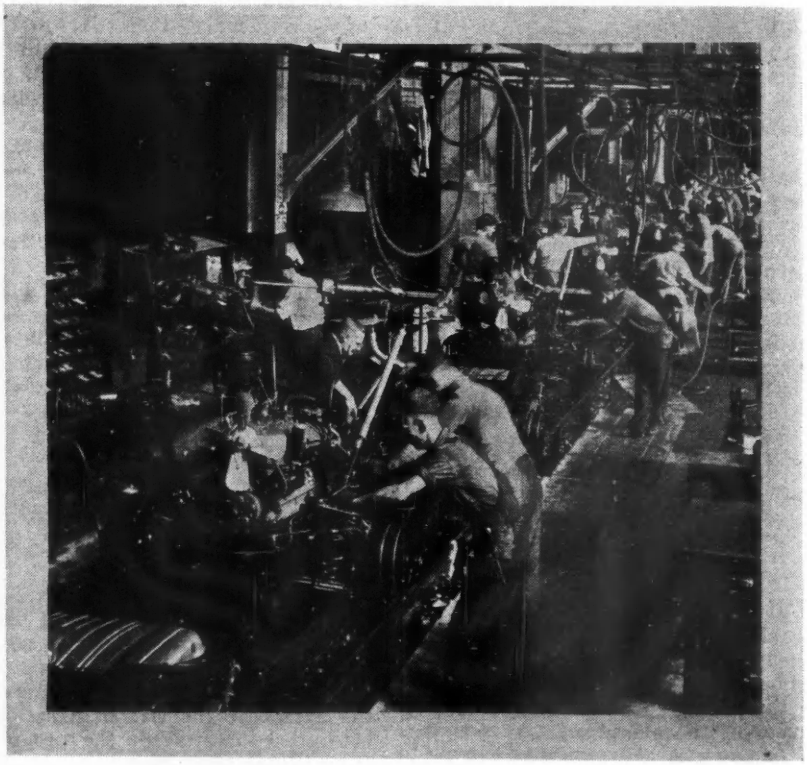
THIS MONTH'S PRODUCTION FEATURE:

PONTIAC

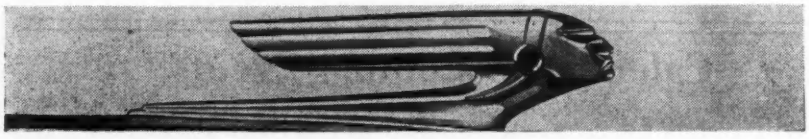
By Joseph Geschelin

A THREE-YEAR planning program embracing an advancement in engineering, improvement in manufacturing facilities, and an aggressive sales policy inaugurated under the leadership of Harry J. Klingler, president of Pontiac Motor Co., has culminated with the presentation of the 1937 Pontiac line at the Auto Shows last month.

Development of this program came in carefully timed steps, the implication of which would not be obvious to those outside of the organization. Now the whole story can be pieced together. The first phase began in 1934, with an outlay of $5,000,000 invested mainly in a new productive set-up for the six-cylinder engine. This was described in complete detail in AUTOMOTIVE INDUSTRIES at the time. The second phase came in 1935 and was distinguished by the expenditure of $2,000,000 on the improvement of manufacturing facilities for the 1936 line. It is of interest to note that $500,000 of the 1935 appropriation was expended for the rebuilding and renovating of the Pontiac foundry which had been idle for four years preceding its reopening early this year.



Approaching end of final chassis line with 1937 models in full swing



Pontiac Factory Executives

General Plant Manager	P. H. MacGregor
General Plant Supt.	S. W. Ostrander
Supt.—Motor Plt.	C. F. Heymann
Supt.—Assembly	S. B. Withington
Supt.—Sheet Metal	D. J. Dunlop
Supt.—Axle	W. R. Hamilton
Supt.—Foundry	R. Snow
Master Mechanic	B. Conway
Chief of Standards	C. A. Ostling
Plant Engineer	T. W. Bradford
Manager Ind. Rel. Dept.	J. W. Brophy
Chief Metallurgist	Z. T. Crittenden
Chief Inspector	W. H. Vann
Material Supervisor	R. J. Longpre
Chief of Police	F. R. Alspaugh
Purchasing Agent	F. J. McLaughlin
Traffic Manager	E. B. Rogers
Parts Mat'l Supr.	G. J. May
Central Stores	H. Miner
Tool Supervisor	J. Wells

We come now to the third phase preparatory to the launching of 1937 cars. For this purpose, Pontiac appropriated $6,000,000 in 1936—of which at least $3,000,000 went into the planning and equipment for the new axle plant, marking the first time that this company has had its own facilities for building axles. Further improvements in the foundry required an additional investment of close to $200,000.

While the engine plant remains substantially as before, so far as layout and equipment are concerned, the observer who may be in a position to com-

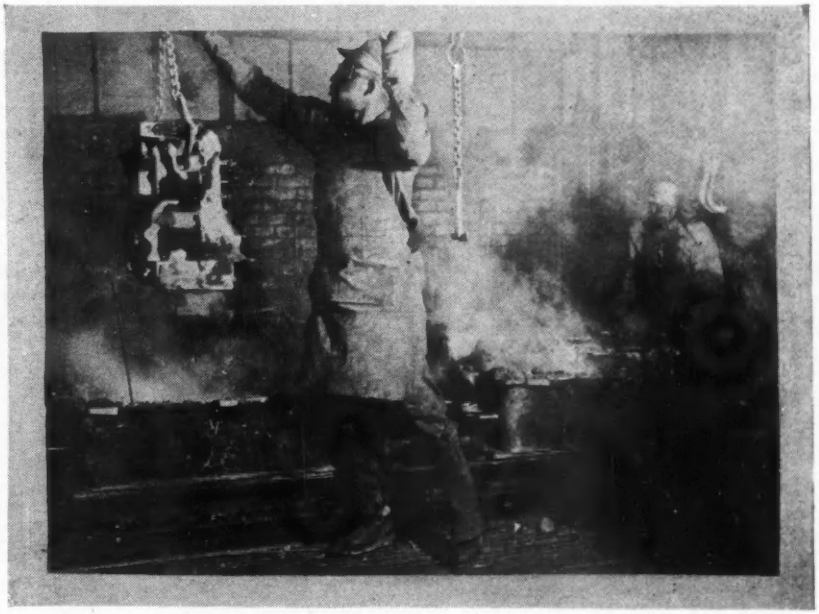
Three-Year Program Culminates in 1937 Production Line

pare what was with what is, as we have been privileged to do, will find many interesting improvements by way of many new items of equipment in almost every department.

So far as introductory remarks are concerned we may place particular emphasis on certain equipment that bulks so largely in the picture. In this category we may place—the great battery of new Gleason gear cutters, gear lappers, and gear testers—a battery of towering Bullards including twelve of the familiar Mult-Au-Matics as well as four of the comparatively new Contin-U-Matics which are used for axle shafts and pistons—a large battery of Davis & Thompson Roto-Matics for connecting rods—many special Ex-Cell-O machines including novel three-way boring machines—and many others too numerous to itemize at this point.

Every year Pontiac introduces some interesting development in one of the manufacturing departments. This year it's the big plating room with tanks capable of handling the new louver sections running up to 62 in. in length. This department, including also a battery of special Divine buffing and polishing machines, is too important to be overshadowed by the new axle plant.

Worker comfort is given a new note by the introduction of a new spray booth principle built into spray booths for finishing the engine, axle housings, and sheet metal. Not only is worker comfort greatly improved but the main-



View at cylinder block shake-out in Pontiac foundry

1937 Pontiac cars getting the final touches as they come down the assembly line

1. Close-up of tooling on Fay automatic lathe used for turning differential case. One setting faces hubs to length, finish-turns pilot diameter, and finish-faces gear seats.

2. Close-up of battery of three, double-index, 8-spindle Bullard Mult-Au-Matics which completely turn ring gear blanks on both sides. Two stations are loading, six are working. Three working stations take front side, the others take back side.

3. Perspective view of battery of 75 new Gleason gear cutters and generators recently installed in axle plant.

4. Barber-Colman machine is used for spline-hobbing stem ends of pinion blanks.

5. Three-way, three-head, Ex-Cell-O precision boring machines bore the differential carrier cross-bores and pinion bore in one setting, automatically.

tenance problem has been successfully solved by the use of effective water sheets which wash down the overspray and prevent accumulation of paint in the spray booth.

Among other things of interest is the huge Niagara washer used for cleaning fenders prior to finishing. When we say huge, we mean that the washer has an overall length of some 140 feet and contains three washing stages in which the temperature is maintained thermostatically at 185 deg. F. Then too, there is the merry-go-round conveyor for the new front sheet metal assembly that will surely take your eye.

Pontiac today utilizes a floor space of 4,000,000 sq. ft. representing, in the main, the plant structures erected in 1927 at a cost of $30,000,000. At peak production it employs 7000 men—of this total, the foundry has contributed 800 men while the new axle plant has added 400 men to the payroll.

To aid our readers in following the great changes that have been wrought here we have divided the discussion under separate headings for some of the principal departments. This gives us an opportunity to cover each phase of the operation rationally and in some detail. In addition, we have shown in tabular form some of the factory routings on the principal parts, listing each operation together with the equipment on which it is performed.

To acquaint everyone with the men responsible for keeping the wheels turning, we have appended a list giving the names and official titles of the factory executive staff headed by P. H. MacGregor, general plant manager.

We might mention at this point that the factory is divided into five basic plants—axle, foundry, sheet metal, assembly, and motor—each one in charge of a superintendent. Naturally, each plant is further subdivided into logical departments under the supervision of foremen and other factory key-men.

Foundry

Early this year Pontiac reopened its foundry which had been idle since 1932. It has four cupolas with a capacity of 700 tons per nine-hour day and seven pouring lines, six of which have been in regular operation the seventh being retooled for six and eight cylinder pistons. The pouring conveyor lines comprise the following units—six and eight cylinder blocks; flywheels; clutch housings; manifold and small parts; and pistons.

For the protection of the workers in the pouring department and at cleaning stations, the foundry is fitted with dust collectors handling not only the shake-outs but drawing off fumes and dirt on the pouring lines from the shrouded conveyors.

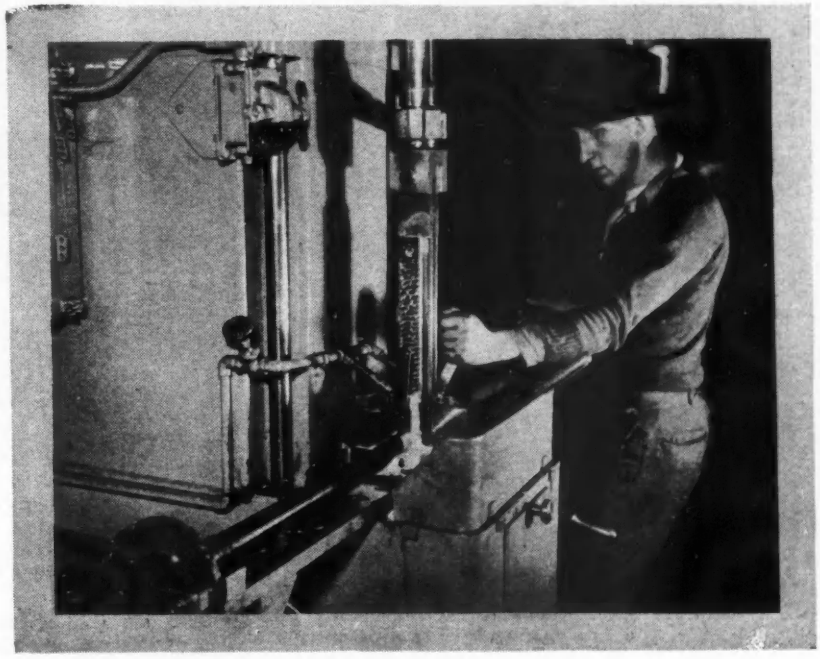
Dry sand cores are used exclusively, the mixture being a synthetic sand composition made up in the foundry by adding clay, sea coal, and betonite (fine clay) to sharp sand. Two types of metal are handled—soft iron for the general run of small casting and hard iron or semi-steel for cylinder blocks, the latter being poured at 2700 deg. F. Cylinder heads and flywheels are of 20-25 per cent steel obtained by mixing soft and hard metal in proper proportions in the ladle.

Complete metallurgical control is exercised at every step. Thus hourly checks are made of both soft and hard iron mixtures, the test bars being analyzed for total carbon, combined carbon, graphitic carbon, manganese, nickel, chromium, etc. In addition physical tests are made for shrinkage, tensile strength, etc. Apart from the laboratory control of sand mixtures, the moisture content is very accurately held, first by driving off all moisture in a special drum type heater, and then adding the desired amount of moisture before preparing the cores.

Although conventional foundry practice prevails throughout, the plant is unique in the method of making up and weighing the cupola charge, regulation dump buckets being used for this purpose. The buckets are placed on platform scales of weighing cars which move back and forth on rails between two rows of bins containing the ingredients for the mix. The exact amount of each ingredient is carefully controlled by the weight indicated on the scale and the record for each batch is noted on a sealed tape. Average bucket load ranges from 1500 to 2000 lb.

The new building program of $500,000 provided the foundry with some new semi-automatic molding machines as well as some special equipment quite novel in modern practice. For example, cylinder block cores are dipped automatically prior to assembly in the molds with a Gracote mixture instead of the conventional graphite coating. This material is said to be more expensive as to first cost but justifies itself by an improvement in the finish of the castings. The foundry is now experimenting with core blowers and will ultimately install a battery of this equipment. They are also experimenting with the new Pangborn shot-blasting machine for automatically cleaning cylinder blocks and will determine whether the new method is more economical than the present sand blast.

One of the most interesting developments now under way is the use of a sand slinger for producing cylinder cores. This is mounted in conjunction with a merry-go-round table on which the steel core mold is built up at several stations, molded at the sand slinger, and then dis-assembled.



This 6-ton LaPointe hydraulic vertical surface broaching machine has double-sided broach-holder finishing ends of two axle shafts to exact length

1. Battery of Gleason lapping machines for running in ring gear sets.

2. Quiet room is used for final inspection of differential carrier assembly. Testing machine provides variable loading conditions permitting operator to rate rear ends as to quietness.

3. Final inspection differential carrier. Note particularly the bar type gage with outside dial indicators for checking pinion bore and alignment.

4. Close-up of one of the big Goss & DeLeeuw quadradial lathes with rotary bed used for turning differential carrier. First station—loading, second station—roughing, third station—semi-finish, fourth station—turn pilot diameter.

5. One of battery of two-spindle Ex-Cell-O horizontal boring machines for facing side gear seats in differential carrier. Unique feature of machine is that cutters are carried in swinging arms—shown in down position—the drive being engaged by bar and sliding spindle actuated by a hydraulic mechanism.

Another unusual device is the new slag conveyor. This consists of a trough connecting the four cupolas in the rear, and traversed by a steel conveyor chain. The trough is fed by a constant flow of water for cooling the mixture are solidifying it before it reaches the outlet end. At the mouth of the trough the slag is collected in a hopper car while the cooling water runs off into a drain in the floor. The slag conveyor not only cleans up the space about the cupolas but has solved the problem of slag disposal since it is no longer necessary to handle large masses of solid waste.

Pontiac is particularly proud of the several new shake out stations and truly these have been worked out with considerable skill. At the cylinder block shake-out, for example, a large inclined air-cylinder is used for dismantling the mold. Following the simple action of pressing a button, the cylinder pries off the cope and casting, enabling the operators to dump out the drag. This arrangement not only expedites the work at the shake-out but removes most of the back breaking labor usually associated with this operation. An even more ingenious automatic device has been installed on the small parts line for shake-out.

Axle Department

One hundred and three new Gleasons, of which 75 are ring gear cutters, are among the 315 modern machine tools recently installed in the axle plant. The department occupies a space of 66,000 sq. ft. and houses equipment valued between $2,500,000 and $3,000,000. It is a self-contained unit convenient to the heat treating department and not far from the main assembly lines. Capacity is 80 units per hour including the complete production of axle shafts, differential gears, ring gears and pinions, differential carrier and case, and carrier assembly.

By virtue of the principle embodied in the new Gleason ring gear cutters, Pontiac is said to be the first plant to utilize a non-generated spiral bevel tooth form which meshes perfectly with a generated pinion. With the new Gleason cutters, the ring gear is completed in one cycle of the machine—11 per hour on roughers and 12 per hour on finishers. This compares with a productivity of only 2½ ring gears per hour on the older type Gleason machines producing generated tooth form.

The new Gleasons for generating differential side gears are of four-spindle type and represent an investment of $14,000 per machine. A battery of 28 Gleason matching and lapping machines completes the installation.

As will be shown in the routings, the axle plant also boasts a large battery of huge Bullards of advanced design. In addition to the well-known Mult-Au-Matics, Pontiac has installed a number of the Contin-U-Matics for the machining of axle shafts.

Another of the "firsts" is a huge neutral atmosphere electric furnace developed by the Electric Furnace Co., for clean, scale-free hardening of axle shafts. This furnace has a capacity of 160 shafts per hour and handles both heat treatment and quenching automatically.

There is a short assembly line for differential carrier assembly and from that point the units are routed to the final inspection "silent" room where each one is tested under variable load and rated as to quietness.

Other new equipment such as the Baker machines, Ex-Cell-O, and Fitchburg are mentioned in connection with

Factory Routing for Connecting Rod

OPERATION	EQUIPMENT
Receiving Inspection	Ball Test Machine Blount grinder Toledo Scales
Coin both ends of pin boss and four spots on each end of crank boss	No. 665—600 ton Toledo Press
Straighten	Bench (2 fixtures)
Drill pin hole	Davis - Thompson 12 - sp. Rotomatic Drill 21 in. Cincinnati 4-sp. Drill
Chamfer and ream pin hole	Oilgear 2-sp. Broach
Broach bolt and nut seats and sides of bolt bosses	Davis - Thompson 12 - sp. Rotomatic
Core drill crank hole	
Burr crank hole one side	Ingersoll Spec. Mill R & F
Split rod from cap	Kent-Owens Mill
Mill joint face of cap	Davis-Thompson continuous drill
Drill bolt holes in Rod and Cap	Davis-Thompson Conveyor
Spotface and c'bore caps	
File burr from top and side of C'bore of cap	Davis-Thompson Continuous Drill
Finish ream rod and cap	
Chamfer holes in cap and rod and burr bolt holes	No. 2—12 in. L. & G. Drill
Center drill, spotface and finish; center in pin boss	Kingsbury Auto. Rotary Drill
Gun drill oil hole in rod	P & W 6-spindle Drill
Repair gun drilled holes	21 in. Cinn. drill
Blow out gun drilled hole	Air Hose
Finish grind joint face of rod and cap	Blanchard Grinder
Burr gun drilled hole and clean out bolt holes	Cincinnati Burring Head
Mill brg. locator slots	No. 2 Kent-Owens Hand Mill
Burr joint faces and assemble rod and cap	Bench
Semi-ream crank hole	24 in. Cincinnati 4-spindle Drill
Chamfer crank hole—both sides	24 in. Cincinnati Drill
Ream crank and pin hole	Davis-Thompson
Mill grooves in both sides of crank boss	No. 2 Kent-Owens Hand Mill
Finish grind both sides of crank boss	Blanchard Grinder
Hollow mill wrist pin boss—both sides	24 in. Cincinnati 4-spindle Drill
Chamfer pin hole both ends	24 in. L & G Drill
Balance for center of gravity	Sundstrand Rigidmill Toledo Scales
Hollow mill pin boss—both sides for correct weight	21 in. Cincinnati Drill Toledo Scales
Remove burrs	Cincinnati Burring Machine Polishing stand
Press in 2 pin bushings	Fox Flexible Press
Burnish pin bushing	Hydraulic Press
Break edges of pin bushings	No. 5 L & G Drill
Remove burrs	No. 6 Mitchell Polishing Lathe
Diamond bore pin end	Excello 4-spindle Diamond Bore Machine
Grind crank hole	Heald Internal Grinder
Repair crank hole (if necessary)	No. 204 Barnes S.S. Honing Machine
Wash rods in Kerosene	Fix and Tank
Blow out drilled hole and wash	Blakeslee Washing Mach.

1. Electric Furnace Co. built this huge heat treating unit for hardening axle shafts. It features a neutral atmosphere which produces scale-free work. Control panels and transformers may be seen in the foreground.

2. Two of the big 8-spindle Cleveland hobbing machines are used for splining the axle shafts.

3. Inspection of differential carrier for accuracy of flange lugs, cross bore, and pinion bore. Note large dial gages to facilitate reading of fine limits.

4. Perspective view of Bullard bay in axle plant. Contin-U-Matics in the foreground, Mult-Au-Matics in the rear.

5. Bullard Contin-U-Matic in close-up showing tooling for turning axle shafts. This is one of a battery of three, six-spindle machines.

the complete routings of individual parts. Among the factory routings are —the pinion gears, side gears, and spider gears. However, the carrier, axle shafts, differential case, and ring gear are described more completely in the succeeding paragraphs.

Let us first consider the machining of the differential carrier. This is characterized by an unusual degree of precision on every operation which is particularly significant on a casting of this size. The first operation is spraying a Duco sealer on the inside surfaces to seal against the loosening of any particles that may not have been removed in the foundry cleaning. The second operation faces carrier flange and lugs on a four-station Goss & DeLeeuw quad-radial automatic chucking machine. On this machine, the first station is loading, second station—roughing, third station—finish face, fourth station—turn pilot diameter. Cemented carbide tools are used.

Operation 3 — combination drilling and reaming flange holes in one setting on a Baker H. D. Vertical Drill. It takes 10 holes in the rim and four holes in lugs. Two of the flange holes are reamed for locating subsequent operations.

Operation 4—On battery of three Fitchburg horizontal three-spindle boring machines for rough bore, semi-finish bore, and semi-finish center hole. These are four-station fixture machines —one loading, three operating. From 0.012 to 0.014 in. of stock is left for the final boring.

Operation 5—Tapping four holes in lugs on 21 in. Cincinnati drill with multiple head.

Operation 6—Assemble bearing caps.

Operation 7—Rough and semi-finish cross-bores on a battery of two Baker double-end boring machines.

Operation 8—Ream and tap cross bore on a battery of two Baker horizontal double-end boring machines.

Operation 9—Precision boring of cross bores and pinion bore in one setting on a battery of two three-way Ex-Cell-O special boring machines using Carboloy-tipped tools. Productivity is 36 pieces per hour at 80 per cent efficiency.

Ex-Cell-O precision boring spindles, of which there are three, are mounted on heavy adjustable slides and are driven and actuated by Ex-Cell-O hydraulic power units. Each boring unit and hydraulic power unit is individually located, but through a remote control valve all three units are started simultaneously or interrupted at any part of the cycle should the occasion demand. The fixture is self-contained and of angle plate type with work located in a hardened locating ring registered from the pilot diameter of the work and radially by means of locating pins in previously reamed bolt holes. The work is clamped at both top and bottom by individual clamps to insure maximum rigidity.

The following operations are required for finishing the differential case:—

Operation 1—Dip in Duco sealer.

Operation 2—Fay automatic lathe, hollow-mill both ends, drill both ends, face, chamfer gear seat and pilot diameter.

Operation 3—Fay automatic lathe, finish-turn hub, semi-finish gear seat face and pilot diameter.

Operation 4—Fay automatic lathe, mounted on arbors to finish face hubs to length, finish turn pilot diameter and finish face gear seat.

Operation 5—Finish grind hub diam-

Factory Routing for Spiral Drive Pinion

OPERATION	EQUIPMENT
Receiving inspection	
Pot anneal	Furnace
Tumble to remove scale	Tumbling barrel
Mill to length	Davis & Thompson Drum Type Mill
Center both ends	Seneca Falls Star Duplex Centering Machine
Rough turn head and stem except thread dia.	5 in. x 12 in. model U Auto. Lo-Swing Lathe
Finish turn head and stem except thread dia.	5 in. x 12 in. model "U" Auto. Lo-Swing Lathe
Turn and chamfer thread dia. chamfer and undercut small bearing diameter	5 in. x 12 in. model "U" Auto. Lo-Swing Lathe
Hob splines	Lees-Bradner model 7-S Single Spindle Auto. Hobber
	No. 12 Barber - Colman Hobber
Stamp ratio, trade mark, and date	Martin Marking Machine
Drill and burr 9/64 hole and recenter	2-B (3) spindle Edlund Drill
Thread	1 in. Single Landmaco Threading Machine
Soft grind small and large bearing diameters and thrust face	10 in. x 18 in. Landis Type "G" Plain Grinder
Inspect	
Rough cut teeth and stamp machine number	No. 15 Gleason Spiral Bevel Gear Rougher
Chamfer teeth	Bilgram Chamfering Machine
Finish generate teeth (drive side)	No. 16 Hypoid Generator
Finish generate teeth (coast side)	No. 16 Hypoid Generator
	18 in. Gleason Gear Tester
Rethread	H. & G. Threading Machine
File burrs	
Wash	Hobart Washer
Burnish teeth	18 in. Gleason Burnishing Machine
Wash	Washer
Soft roll	18 in. Gleason Testing Machine
Carburize—harden from furnace	Gas fired furnace
Wash	Washer
Draw	Machler Draw Furnace
Clean (wire brush)	Polishing stand
Inspect for hardness	
Polish centers	2-B Edlund Drill
Straighten	15-ton Metalwood Press
	48 in. Table
Inspect for runout	Bench center
Semi-finish grind large bearing diameter, finish grind small bearing dia. and thrust face	10 in. x 18 in. Landis Plain Grinder
Final inspect	

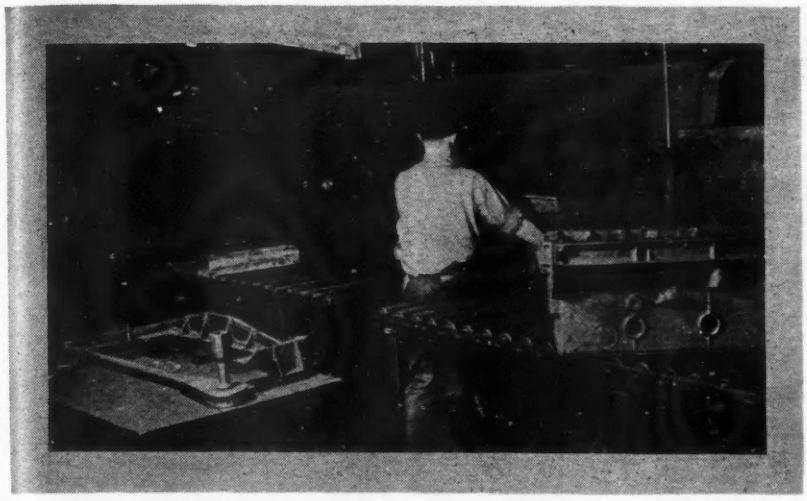
1. Looking into the huge Cincinnati Centerless used for semi-finish grinding the center bearing diameter on the axle shaft.

2. Close-up of a pair of heads on the new Divine polishing machine. Note particularly how the heads move on universally-mounted trunnions so as to reach every part of the work.

3. General view of portion of the new plating department showing, in the right hand corner, some of the long louver and hood sections handled here.

4. One of three Fitchburg 3-spindle horizontal boring machines equipped with four-station fixture for handling differential carrier. Boring tools are made in steps to take three diameters in the center hole. Three operations are required—rough, semi-finish, and second semi-finish bore—leaving 0.012-0.014 in. for the Ex-Cell-O boring machine.

5. One of the two big LeBlond crankshaft lathes installed on the 6-cylinder line.



Huge 120 in. Oilgear horizontal surface broaching machine cuts bearing locks and main bearing-ball form in one pass, on six-cylinder blocks

eters on Landis grinder with housing mounted on arbors from previous operation.

Operation 6—Face side gears seats on horizontal 2-spindle Ex-Cell-O boring machines. Two machines are used, one for counterboring the side gear hub, the other for facing the side gear seat.

This machine has a welded steel base with two spindles individually driven and actuated by Ex-Cell-O hydraulic power units. Each unit is provided with a rotary type fixture in which one differential case is located on the trunnion hubs in one direction and a pilot entering the spider bores in the other direction. The cutter is supported on a hinged overhead leaf and is operated by a driving bar from the hydraulic unit. When this leaf is dropped into place, the boring bar is advanced by the hydraulic power unit and enters the fixture, passing through the hole in the hub of the work, picking up the cutter and then feeding it into the work to the proper depth. The return cycle is automatic.

Operation 7—Facing seat for spider gears on Ex-Cell-O vertical boring machines.

Axle shafts have been tooled up in a distinctive manner as will be evident from the following routing:

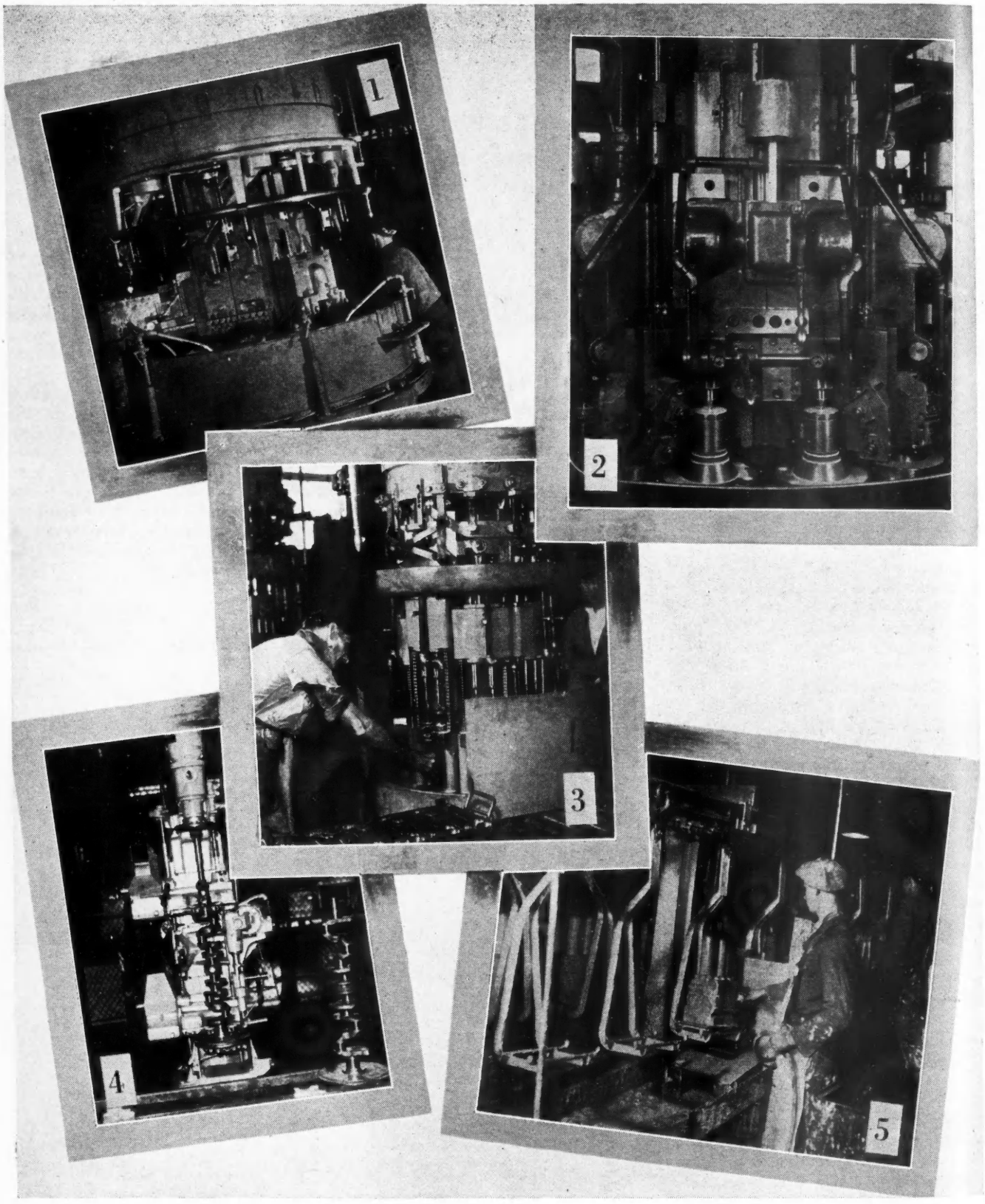
Operation 1—Baker drill press, hollow-mill flange O.D. to provide locating point for straightening after heat treat.

Operation 2—Electric furnace unit for heat treatment. Unique features of the installation include the grids from which electrical heat is radiated, the automatic control system, and a means by which a non-oxidizing gas or atmosphere is maintained within the high-temperature hardening furnace. The hardening furnace, together with the gas-seal hoods at either end, is some forty feet long by seven wide, and extends twelve feet above the floor at its highest point. Heavy doors at either end seal in heat and atmosphere, sinking into pits when opened. The gas seal hoods are chambers in which the doors operate, together with adjacent elevators, one in each hood. A frame outside of either hood carries rails upon which a second elevator runs, operated as part of the mechanical handling system by which the work is passed in and out of the furnaces.

At the discharge end of the hardening furnace, a large tank is embedded in the floor, and filled with a quenching medium circulated by means of a centrifugal pump. This tank furnishes the means of rapidly cooling the work from the furnace temperature, and hardening it. To the ends of the hardening furnace framings are attached semi-circular tracks, running to the ends of the draw furnace, which is similar to the hardening furnace in construction, but somewhat lighter in insulation. The draw temperature is not sufficiently high to form scale upon the axles, and consequently, no provision is made to fill this furnace with a non-oxidizing atmosphere.

Factory Routing for Ring Gear

OPERATION	EQUIPMENT
Receiving Inspection	
Anneal	Furnace
Rough and finish face back, rough and finish bore, rough and finish gear face and back angle; rough and finish c'core and face web	8 in. 8-spindle Double Index Mult - Au - Matic Bullard (Battery of three)
Stamp trade mark, ratio and date	Martin Marking Machine
Broach hole	American Vertical Hyd. Press
Drill (12) tap holes	24 in. Cincinnati Drill
Countersink tap holes	24 in. Cincinnati Drill
Tap (12) holes	24 in. Cincinnati Drill
Grind back	Mod. DB Walker Surface Grinder
Inspect	Bench
Rough cut teeth and chamfer	No. 11 Gleason Hypoid Rougher
Finish cut teeth and stamp	No. 11 Gleason Single Cycle Gear Finisher
	No. 16 Gleason Hypoid Gear Finisher
	18 in. Gleason Tester
Wash	Hot Water Tank
Test gears for tooth contact with pinion and inspect visually; stamp date	18 in. Gleason Tester
Wash	Hobart Washer
Pack, carburize and harden	Furnace
	Gleason Quenching Machine
Wash	Hobart Washer
Draw	Maehler Draw Furnace
Wire Brush	Polishing Stand
Inspect Heat Treat for runout and hardness	
Grind hole from P.D.	No. 72A3 Heald Internal Grinder
Inspect	



1. Part of the battery of Bullard Mult-Au-Matics for roughing and finishing flywheels.

2. Pistons are turned automatically on a group of Bullard Contin-U-Matics. As pistons come off the machine, the operator sends them down a gravity chute to the next operation.

3. View of one of a battery of Davis & Thompson Roto-Matics installed on the connecting rod line. The machine in the foreground drills and taps connecting rod bolt holes.

4. New GMR balancing machine is used for dynamic balance of crankshaft and clutch assembly. The machine has a vertical drilling attachment, seen in the foreground, for drilling the balance holes in the flywheel.

5. Cylinder cores are dipped automatically at this foundry station as they move along on the overhead conveyor. The operator is blowing off the surplus Gracote material.

Operation 3—Brinell hardness test on Grogan Machine.

Operation 4—Straighten.

Operation 5—6-ton LaPointe vertical hydraulic broaching machine for broaching spline ends, two shafts at a time.

Operation 6—Seneca Falls Duplex Centering machine for double-end centering.

Operation 7—Battery of three, 10-in. six-spindle Bullard Contin-U-Matics, each completes following operations in one setting—turn spline diameter, turn bearing diameter, oil slinger diameter, face inside of flange. The self-energizing chuck for work holding at the large end is an unusual feature of the machine.

Operation 8—Huge No. 5 Cincinnati Centerless grinder is used to rough-grind bearing and finish-grind spline diameter.

Operation 9—No. 2 Cincinnati Centerless used to semi-finish center bearing diameter.

Operation 10—Battery of five 12-in. six-spindle Bullard Mult-Au-Matics completes following operations in one setting—straddle-face flange, turn and chamfer pilot diameter, drill and countersink 5 bolt holes. The latter is handled at a station equipped with a special Bullard Multiple drilling head.

Operation 11—No. 2 Cincinnati Centerless grinder faces outside flange and finish-grinds pilot diameter in one setting with a single wheel.

Operation 12—10 x 36 Landis plain grinder for rough-grind diameter.

Operation 13—Eight-spindle Cleveland hobber for hobbing spline end.

Operation 14—No. 2 Cincinnati centerless, finish-grind bearing diameter.

Operation 15—Toledo press used to serrate bolt holes in flange.

The detailed routing on the new ring gears is given in tabular form elsewhere in this article. We might mention at this point that one of the most interesting operations to be found in this set-up is that of turning the ring gear blank on a battery of three 8-in., 8-spindle Type D, Bullard Mult-Au-Matics, each of which completes the gear blank front and back faces in two cycles. Six stations are working, two loading. Three stations take the front side, the other three take the back side. In operation, the blanks are loaded, go through one cycle of the machine, then removed and turned over to take the other side. Thus two settings are required in each machine to completely turn the blank.

After heat treatment, the rings gears are returned to the machine shop on a conveyor. The pinions, also, are returned and have the centers cleaned and having diameters finish-ground. Having completed this preparation, ring gears and pinions are ready for the final matching operations. Four Gleason matching machines are used for a preliminary matching of ring gears and pinions, followed by lapping of matched sets on a battery of 17 new Gleasons.

Engine Production

Although the engine plant is basically the same in layout and general tooling, as it has been since the six-cylinder block was retooled several years ago, the observer will find many important changes in equipment at various points. In some cases the new equipment policy was dictated by the demand for greater productivity; in many cases it recognized the superiority of this or that new method. Some of the changes will be discussed in detail below.

Coming first to the cylinder block we find that very little change has taken place. Yet here is a horizontal Oilgear broaching machine, one of the largest of its kind, installed in the six-cylinder block line. This is a surface broach designed to cut the bearing seats and form the main bearing half section in one pass of the broach. The machine has a stroke of 120 in. and can push the broach with a force of 50,000 pounds, if that much pressure were required.

With the increased potential sales for the six, Pontiac has found it necessary to install two of the big 4-AC LeBlond crankshaft lathes to supplement the present equipment. On the eight-cylinder crankshaft we find a self-contained battery of the new Leland-Gifford crankshaft drilling machines fitted with the well-known step-by-step hydraulic feed units. There are four units in this battery with a self-contained lubrication system.

The first three units are 64 x 45 in. while the fourth unit requires a clear floor space of 81 x 45 in. The first unit drills a 5/16 in. hole to depth in No. 1 and No. 8 pins; a 5/16 in. hole in the center bearing; and one 3/16 in. angu-

Factory Routing for Differential Side Gear

OPERATION	EQUIPMENT
Receiving Inspection	
Anneal	Furnace
Drill hole	21 in. Cincinnati Single Spindle Drill
Round broach hole	LaPointe Vertical Broach
Chamfer gear end of hole	21 in. Cincinnati Drill
Chamfer hub end of hole	24 in. Cincinnati Drill
Broach spline	LaPointe No. 2-L Horiz. Hyd. Broach
Straddle face end of hub and gear end	Seneca Falls Lo-Swing Lathe
Rough and finish turn hub and gear O.D., rough and finish gear seat, neck and chamfer; rough and finish O.D. and gear face	8 in. 6-spindle Single Index Bullard
Grind hub	Mult-Au-Matic, type A 6 in. x 18 in. Landis Plain Grinder
Grind back face	6 in. x 18 in. Landis Plain Grinder
Inspect	
Rough and finish cut teeth	No. 9 Gleason Completing Generator
Burr teeth	21 in. Cincinnati Drill Press
Wash	Washer
Soft roll and try out	18 in. Gleason Tester
Inspect	
Carburize and harden	Furnace and Tank
Draw	Homo Tempering Furnace
Wire brush	Polishing Stand
Inspect for hardness	
Burnish spline	5-ton LaPointe Vertical Press
Finish grind hub	6 in. x 18 in. Landis Plain Grinder
Finish grind back face	6 in. x 18 in. Landis Plain Grinder
Polish back of gear	No. 2—14 in. Leland-Gifford Drill Press
Inspect	

1. Taylor-Winfield flash welder of new type is installed in press shop for welding corner on front fender.

2. Radiator grille section being formed on McKinney roll-forming machine in Pontiac press shop.

3. Eight-station Ex-Cell-O machine is used for form-cutting two grooves and chamfer on lower end of valve stem.

4. Step-by-step drilling of crankshaft oil holes on the 8-cyl. crank is accomplished on a battery of new Leland-Gifford drills fitted with the hydraulic step-by-step drill feed mechanism.

5. Pontiac one-piece front fender is drawn in one operation on the double-action press shown here.

lar hole in the flange. The second unit drills 5/16 in. holes to depth in No. 3 and No. 6 pins; 5/32 in. holes with a multiple head in pins 4 and 5; drills 5/32 in. in pins 2 and 7; and 3/16 in. angular hole in flange end. The third unit drills 5/16 in. hole to depth in pins 4 and 5, and 3/32 in. hole in pins 1 and 8. The fourth unit drills 5/16 in. hole vertically in pin 2 and 5/32 in. hole horizontally in pin 3 in one fixture; 5/16 in. hole vertically in pin 7 and 5/32 in. hole horizontally in pin 6 in a second fixture.

The biggest change has been made in the connecting rod equipment with the installation of a battery of Davis-Thompson Roto-Matic machines replacing conventional multiple spindle drilling machines. Complete details of the tooling will be found in the routing shown elsewhere in this article. Note the 12-spindle Roto-Matics as well as the smaller continuous drilling machines of the same type. An Oilgear surface broach is used for forming sides of belt bosses as well as bolt and nut seats in one setting.

The connecting rod also features an Ex-Cell-O, 4-spindle diamond boring machine for finishing the pin end and a Heald internal grinder for the crank end. The well-known Pratt & Whitney 6-spindle drill is used for rifle drilling the oil gallery.

This year Pontiac has extended the procedure for balancing reciprocating parts to the very limit. For example, in addition to a complete balancing of the crankshaft, they now make up the clutch and crank assembly and balance the entire unit. This is done on an improved GMR vertical balancing machine with a vertical drill attachment which permits the drilling of holes in the flywheel while the unit is in place.

Bullard also is well represented in this department. There is a battery of Contin-U-Matics turning pistons; and four Bullards on the semi-finish and finish-turning of flywheels—two machines are used for each of these operations, completing the job in one setting on each machine. Finish turning is done on a battery of two new 12 in. 6-spindle type D Mult-Au-Matics.

Ex-Cell-O has installed a very interesting special machine which is used for cutting the two grooves in the lower end of the valve stem. The machine is cylindrical in form with the worktable at convenient height to permit loading and unloading with facility. It has a capacity of eight valves at a time, the cutting cycle being automatic, the operator's function confined to loading and unloading. Eight forming tools are located on the interior of the machine, one at each station. These forming tools are of high-speed-steel and are designed to form, in one setting, the two grooves as well as the chamfer at the lower end of the stem. Productivity is estimated at about 1500 valves per hour.

It may be inferred from the foregoing that the engine line came in for its share of attention in the new program, judging by the improvements found at many points.

Press Shop

For 1937 Pontiac shifts to a one-piece front fender. By close harmony between the sheet metal experts and the engineering department they have developed a unique set-up which permits the drawing of the fender in just one double-action press. This is indeed an accomplishment. It so happens that the inside rear corner, a comparatively small section, would have transformed a simple drawing job into a complicated series of draws and restrikes. So they short cut by leaving off the corner, so far as the press work is concerned, and then weld it on in a subsequent operation. For this welding operation we find two large Taylor-Winfield flash welders of advanced design which handle the job automatically.

Metal finishing of the fenders is quite conventional. However, they are justly proud of a tremendous Blakeslee washing machine for cleaning the fenders in preparation for paint. This washer is made up of three separate units, each of which can be operated independently and with a different concentration of cleaner. The machine is about 140 ft. in length and thermostatically controlled, the temperature for the present set-up being maintained at 185 deg. F.

As may be evident from the appearance of the new cars, the hood louver and grille sections have been changed materially and consequently have entailed a change in the press shop set-up. Hood louver sections now are made in four operations, in two separate presses, each one having two dies. Thus each section goes through each press, twice, for a total of four operations. Radiator grille sections this year are formed on a new roll-forming machine supplied by McKinney.

Another newcomer to the press shop is a special gas tank seam welder made by the National Welding Machines Co. The unique feature of this welder, differentiating it from others of current design, is the use of extremely large diameter (20 in.) welding rolls which are expected to improve the seam and greatly increase the life of the tools.

Factory Routing for Steering Knuckle

OPERATION	EQUIPMENT
Receiving Inspection	Brinnell Test Machine Blount Stand Grinder Gage to check rough casting
Snag flash	Snagging Stand Percentage operation
Coin sides of yoke & spindle	No. 663 .400-ton Toledo Press
Mill tips of bolt bosses on one side	No. 2 Kent-Owens Hand Mill
Center both ends	4 in. x 12 in. Sundstrand D.E. Centering Machine
Rough & finish turn & chamfer	No. 3 Turn Mill
Rough grind spindle brgs.	Cincinnati Centerless Grinder
Finish turn shoulder Dia.	Sundstrand Lathe
Broach inside of yoke Broach end of king pin bosses Broach sides and ends of bolt bosses	Colonial Vertical Hyd. Broach
Combination drill & ream (4) bolt holes	24 in. Cincinnati 2-spindle drill
Drill (2) oil holes (1) RH & (1) LH Knuckles at a time	21 in. 2-spindle Cincinnati drill
Chamfer oil holes & bolt holes sides)	21 in. Cincinnati Single Spindle
Tap (2) oil holes in LH knuckle Tap (2) oil holes in RH knuckle	21 in. Cincinnati Drill with tapping attach.
Mill loc. spots on lugs	Kent-Owens Hand Mill
Drill, bore & ream king pin hole	Excello 2-way Machine
Drill, bore & ream king pin hole	Excello 2-way Machine
Burr king pin hole	Cinn. Burring Machine
Spotface spindle dia. & chamfer	24 in. Cincinnati Drill

1. New Toledo scale with Vickers hydraulic unit for applying pressure is used in testing knee-action coil springs adopted for 1937. This equipment is used in receiving inspection.

2. Front end sheet metal for the 1937 Pontiac is assembled as a unit on the bucks shown here and set down on the chassis.

3. Pontiac fenders entering the first stage of the three-section Blakeslee washer which has an overall length of some 140 ft.

4. National Welding Machines built this seam-welder for producing gas tanks. A unique feature of the machine is the use of welding tools of 20 in. diameter, said to improve the quality of the weld and increase tool life. Note that the work is automatically indexed by means of the gear and rack mechanism at the lower section of the fixture.

5. The rigid propeller shaft connection from the transmission extension to the axle is tested for dynamic balance on the new GMR balancing machine shown here. It checks balance at both ends, readings being taken on each of two scales which are shrouded.

Plating Department

Each year the Pontiac manufacturing division springs a surprise. This time it's a bigger and better plating department. Apart from the fact that better facilities were required in view of the demand for better electroplated finishes, they also had the problem of handling the long louver and hood line sections—running 62 in. in length on the Eights. Thus we find the new department fitted with some very large tanks to accommodate the long narrow sections comfortably.

This department has complete facilities for plating copper, bright nickel, and chromium. Due to the nature of the work, automatic plating conveyors are not used here. However, the entire department is traversed by an overhead monorail on which the work-holding racks are conveniently transported. The large racks are suspended from hoists, making it possible for the operator to lower the load quickly and without manual effort.

A really outstanding feature of the department is the installation of a battery of automatic buffing and polishing machines developed by Divine Bros. Buffing machines have four heads and are 33 ft. in length; polishing machines have 10 heads each and are 63 ft. in length.

Miscellaneous Details

Before leaving this discussion of plant equipment it will be of interest to get a better picture of the new spray booths which have been installed in various departments. In this development, Pontiac has had the advantage of the current experience with several makes of spray booths and the units installed here represent the last word known to the art.

The spray booths were built by the Industrial Sheet Metal Co., to specifications. They are thoroughly vented to eliminate fumes and odor and thus contribute largely to worker comfort. For this purpose the booth is open in front and has large openings at the sides. The top is connected to a powerful exhaust system which creates suction and forces air circulation from all sides. The back sheet and bottom sheet are insulated by a continuous water sheet from a system of nozzles, carrying away the over-spray most efficiently. In fact, with the newly-designed water sheets there is no sticking of paint at any point. No attempt is made to salvage the over-spray sludge. This is collected in a sump at the rear of the booth and dumped out at regular intervals. The waste water is screened and then recirculated.

The steering knuckle is a new manufactured part in this plant. The routing is given in detail elsewhere but we draw your attention particularly to the many interesting operations that have been introduced. Chief among these is the Turnmill which is used to rough and finish turn and chamfer in one setting. A Cincinnati Centerless is used to rough-grind the spindle bearings. The interior surfaces are surface-broached in one pass on a Colonial vertical broaching machine.

This year the universal joint construction is new, comprising an extension with a slip-joint in the transmission, coupled with a shorter propeller shaft to the axle. The propeller shaft is fitted with universal joints at each end but the yokes are welded to the tube. The rear shaft is made up to very precise specifications particularly as to dynamic balance and this feature is checked 100 per cent on a new GMR balancer set up in the receiving inspection.

Another new item is the large coil spring for knee-action front end. These springs are tested 100 per cent on a Toledo scale calibrated for the purpose.

Factory engineering is mighty proud of a process for reclaiming carburizing material placed in operation this season. The tangible results of the process are—efficient salvage of material, less hand labor and better worker comfort, and faster cooling of carburizing compound thus reducing the inventory of this material.

For reclaiming, the unloading station has been fitted with a shaker grate on which the carburizing material is dumped out. A water spray is played on the material to put out the flame. As the material drops through the grates it is collected on a conveyor which carries it to a cooling tower. After this stage, the carburizing material is blown by an air blast into a large hopper. During the process, the light burned ash and waste material is separated from the heavier unused material and is picked up by the dust collector.

The hopper which collects the useable salvaged material also is used for making up the mixture of salvaged and new material, in the ratio of six parts old to 1 part new.

The foregoing covers some of the most interesting highlights of this plant, since obviously it would not be possible to take up every phase of the operation within the confines of a single article. The final assembly continues about as before. We might mention, however, that the final line has been fitted with a new machine for setting head lamp adjustment; also a new device built into the conveyor for setting front end alignment.

Factory Routing for Differential Small Pinion

OPERATION	EQUIPMENT
Drill, ream, form, chamfer, and cut off	3½ in. cone automatic—4-spindle Screw Machine
Chamfer, cut off end	2-B Edlund Drill
Ball burnish hole to size	Air Cylinder
Inspect	
Rough and finish gear teeth	No. 9 Gleason Completing Generator
Burr teeth	21 in. Cincinnati Drill
Wash	Washer
Inspect soft roll	Gleason Tester
Carburize and harden	Furnace and Tank
Draw	Homo Furnace
Wire Brush	Polishing Stand
Inspect for hardness	Rockwell Hardness Tester
Grind hole	No. 81 Heald Internal Gagematic Grinder
Grind spherical radius	6 in. x 18 in. Landis Self-contained Grinder
Polish spherical seat	No. 2—14 in. Leland-Gifford Drill
Wash	
Inspect	

LUBRICATION AND FUEL SYSTEM

Line Number	CAR MAKE AND MODEL	ENGINE: Type Lubrication	Oil Pressure to: Main Bearings	Oil Pressure to: Connecting Rods	Oil Pressure to: Wristpins	Oil Pressure to: Camshaft Bearings	Oil Pressure to: Rocker Arms	Timing Gear or Chain	Oil Pump Type	Lubricant Recommended S.A.E. No.: Summer	Lubricant Recommended S.A.E. No.: Winter	Normal Oil Pressure Lbs. at M.P.H.	Relief Valve Opens—Lbs. Pressure	Crankcase Capacity—(Quarts)	Oil Pressure Gage—Make	Oil Reservoir Cage—Type	External Oil Filter—Make	Oil Cooler—Make	CHASSIS: Type	CHASSIS: Make	Crankcase Ventilated	Gasoline Tank Capacity	Fuel FEED: Type	Fuel FEED: Make	CARBURETOR: Make	CARBURETOR: Model	CARBURETOR: Size	CARBURETOR: Type	SUPER-CHARGER: Make	SUPER-CHARGER: Type	SUPER-CHARGER: How Driven	Manifold Heat Control	Automatic Choke—Make	Air Cleaner—Make	Exhaust Pipe Diameter	Muffler—Make	Line Number
1	American-Bantam	P	Y	Y	N	Y								5					CP	AC									No	No	No						1
2	Auburn 654	P	Y	Y	N	Y			G	30	20W	37–40‡		6		Bay	Pur	No	P	AH	Y	20	CP	AC	Str	EX-22	1¼	S-DD	No	No	No	Au	No	AC	2	Buf	2
3	Auburn 852	P	Y	Y	N	Y			G	30	20W	37–40‡		8		Bay	Pur	No	P	AH	Y	20	CP	AC	Str	EE-1	1	D-DD	No	No	No	Au	No	AC	2¼	Buf	3
4	Auburn SC-852	P	Y	Y	N	Y			G	30	20W	37–40‡		8		Bay	Pur	No	P	AH	Y	20	CP	AC	Str	EX-32	1½	S-DD		Cen	GPf	Au	No	AC	2¼	Buf	4
5	Buick 37-40	P	Y	Y	N	Y	Y	Po	G	30	20	45–35	45	6	AC	Bay	No	No	P	Ln	Y	18	CP	AC	Str	AA-1	1	D-DD	No	No	No	Th	DR	AC	2	Wal	5
6	Buick 37-60	P	Y	Y	N	Y	Y	Po	G	30	20	45–35	45	8	AC	Bay	No	No	P	Ln	Y	18	CP	AC	Str	AA-2	1¼	D-DD	No	No	No	Th	DR	AC	2¼	Wal	6
7	Buick 37-80	P	Y	Y	N	Y	Y	Po	G	30	20	45–35	45	8	AC	Bay	No	No	P	Ln	Y	20	CP	AC	Str	AA-2	1¼	D-DD	No	No	No	Th	DR	AC	2¼	Wal	7
8	Buick 37-90	P	Y	Y	N	Y	Y	Po	G	30	20	45–35	45	8	AC	Bay	No	No	P	Ln	Y	20	CP	AC	Str	AA-2	1¼	D-DD	No	No	No	Th	DR	AC	2¼	Wal	8
9	Cadillac V8-60	P	Y	Y	Y	Y		Po	G	30	20W	30–60	30	7	AC	Bay	Han	No	P	Ln	Y	22	CP	AC	Str	AA-25	1¼	D-DD	No	No	No		Str	AC	2¼	Old	9
10	Cadillac V8-65	P	Y	Y	Y	Y		Po	G	30	20W	30–60	30	7	AC	Bay	Han	No	P	Ln	Y	25	CP	AC	Str	AA-25	1¼	D-DD	No	No	No		Str	AC	2½	Old	10
11	Cadillac V8-70	P	Y	Y	Y	Y		Po	G	30	20W	30–60	30	7	AC	Bay	Han	No	P	Ln	Y	25	CP	AC	Str	AA-25	1¼	D-DD	No	No	No		Str	AC	2½	Old	11
12	Cadillac V8-75	P	Y	Y	Y	Y		Po	G	30	20W	30–60	30	7	AC	Bay	Han	No	P	Ln	Y	25	CP	AC	Str	AA-25	1¼	D-DD	No	No	No		Str	AC	2½	Old	12
13	Cadillac V12-85	P	Y	Y	Y	Y		Po	G	30	20W	30–60	14	9	AC	Bay	Han	No	P	Ln	Th	25	CP	AC	DL	51	1½	2-SU	No	No	No		DL	AC	2½	Own	13
14	Cadillac V16-90	P	Y	Y	Y	Y		Po	G	30	20W	30–60	14	10	AC	Fl	Han	No	P	Ln	Th	30	CP	AC	DL	51	1½	2-SU	No	No	No		DL	AC	2½	Old	14
15	Chevrolet Master	P	Y	Y	N	Y	Y	Po	G	20	20W	13.5–50	75	5	AC	Bay	No	No	P		Y	15	CP	AC	Car	W-1	1¼	S-DD	No	No	No	Au	No	AC	1⅞	Own	15
16	Chevrolet Master De Luxe	P	Y	Y	N	Y	Y	Po	G	20	20W	13.5–50	75	5	AC	Bay	No	No	P		Y	15	CP	AC	Car	W-1	1¼	S-DD	No	No	No	Au	No	AC	1⅞	Own	16
17	Chrysler Royal C-16	P	Y	Y	N	Y		Po	G				42½	5		Bay	Pur	No	P	A-H	Y	16	CP	AC	Car	BB	1½	S-DD	No	No	No	Au	Yes	Bur			17
18	Chrysler Imperial C-14	P	Y	Y	N	Y		Po	G				42½	6		Bay	Pur	No	P	A-H	Y	16	CP	AC	Str	AAOV-1	1½	D-DD	No	No	No	Au	Yes	AC			18
19	Chrysler Custom Imperial C-15	P	Y	Y	N	Y		Po	G				42½	6		Bay	Pur	No	P	A-H	Y	20	CP	AC	Str	AAOV-1	1½	D-DD	No	No	No	Au	Yes	AC			19
20	Chrysler Airflow C-17	P	Y	Y	N	Y		Po	G				42½	6		Bay	Pur	No	P	A-H	Y	21	CP	AC	Str	EE-22	1¼	D-DD	No	No	No	Au	Yes	AC			20
21	Cord Front Drive 812	P	Y	Y	Y	Y	Y	Po	G	30	20W	40-ND		7	SW	Bay		No	P	A-H	Y	20	CP	AC	Str	EE-15	1	D-DD	No	No	No	No	Str	AC	2	NS	21
22	De Soto S-3	P	Y	Y	N	Y		Po	G				42½	5		Bay	Pur	No	P	A-H	Y	16	CP	AC	Car	BB	1½	S-DD	No	No	No	Au	Yes	Bur			22
23	Dodge D-5	P	Y	Y	N	Y		Po	G				42½	5		Bay	Pur	No	P	A-H	Y	16	CP		Str	EXV-2	1¼	S-DD	No	No	No	Au	Yes	AC			23
24	Duesenberg 8	P	Y	Y	Y	Y		Po	G	60	50	30–25		12	Mot	F	Pur	No	Cen	Bij	Y	26	CP	SW	Str	(a)	1½	D-DD	No	No	No	Au	No	AC	4¾	Own	24
25	Ford V8-60													4							Y				Str	EE-1											25
26	Ford V8-85		Y	Y		Y		Po	G			*		5							Y		MP		Str	EE-1		D-DD	No	No	No				1.88		26
27	Graham Crusader 85	P	Y	Y	N	Y		Po	G	30	20W	40–30	50	5		Bay		Own	P	A-H	Y	12	CP	AC	Mar	B2-SU	1¼	S-DD	No	No	No	Au		Bur	1⅝	Old	27
28	Graham Cavalier 95	P	Y	Y	N	Y		Po	G	30	20W	40–30	50	5	Own	Bay		Own	P	A-H	Y	15	CP	AC	Mar	B-2	1¼	S-DD	No	No	No	Au		Bur	2	Old	28
29	Graham Supercharger 116	P	Y	Y	N	Y		Po	G	30	20W	40–30	50	5		Bay	Fram		P	A-H	Y	15	CP	AC	Mar	B-2	1½	S-DD	Own	Cen	Belt-2	Au		Bur	2	Old	29
30	Graham Supercharger 120	P	Y	Y	N	Y		Po	G	40	20W	40–30	50	5		Bay	Fram	Own	P	A-H	Y	15	CP	AC	Mar	B-3	1½	S-DD	Own	Cen	Belt-2	Au		Bur	2	Old	30
31	Hudson 73	Sp	N	N	N	N	N	Sp	OP	30	10W	3–	3	5	None	No	None	Own	P	A-H	Y	16½	CP	AC	Car	344-S	1	D-DD	No	No	No	Au	Car	AC	2	Old	31
32	Hudson 74-5-6-7	Sp	N	N	N	N	N	Sp	OP	30	10W	3–	3	7	None	No	None	Own	P	A-H	Y	16½	CP	AC	Car	344-S	1	D-DD	No	No	No	Au	Car	AC	2	Old	32
33	La Salle 37-50	P	Y	Y	Y	Y		Po	G	30	20W	30–60	30	7	AC	Bay	Han	No	P	Ln	Y	22	CP	AC	Str	AA-25	1¼	D-DD	No	No	No	No	Str	AC	2¼	Old	33
34	Lincoln Zephyr		Y	Po		Y		Po		40	10W	30–	30	6					P	A-H			MP				1	D-DD	No	No	No			Bur			34
35	Lincoln V12																Pur																				35
36	Nash Lafayette 400-3710	P	Y	Y	Y	Y		Po	G	30	20	30–20	30	6		Bay	No	No	P	A-H	Y	20	CP	AC	Str	EX-22	1¼	S-DD	No	No	No	Au	No	Bur	2		36
37	Nash Ambassador 6-3720	P	Y	Y	Y	Y	Y	Po	G	30	20	30–20	30	7		Bay	B&S	No	P	A-H	Y	20	CP	AC	Str	EX-2	1½	S-DD	No	No	No	Au	No	Yes	2		37
38	Nash Ambassador 8-3780	P	Y	Y	Y	Y	Y	Po	G	30	20	30–20	30	7		Fl	B&S	No	P	A-H	Y	20	CP	AC	Str	EE-7	1	D-DD	No	No	No	Au	No	Bur	2¼		38
39	Oldsmobile F-37	P	Y	Y	Y	Y		Po	G			27–	27	6	AC	Bay	No	No	P		Y	18	CP	AC	Car	351-S	1¼	S-DD	No	No	No	Au	Car	AC	2	Var	39
40	Oldsmobile L-37	P	Y	Y	Y	Y		Po	G			27–	27	7	AC	Bay	No	No	P		Y	18	CP	AC	Car	345-S		D-DD	No	No	No	Au	Car	AC		Var	40
41	Packard Six	P	Y	Y	Y	Y		Y	G	30	20W	35–30		7		Bay	None	No	P		Y	17	CP	AC	CG		1¼	S-DD	No	No	No	Au	Yes	ACO	2		41
42	Packard 120-C	P	Y	Y	Y	Y		Y	G	30	20W	35–30		7		Bay	None	No	P		Y	20	CP	AC	Str	EE-14	1	D-DD	No	No	No	Au	Yes	ACO	2¼		42
43	Packard Super Eight	P	Y	Y	Y	Y	Y	Y	G	30	20W	35–30		8		Bay	Pur	Yes	P		Y	25	CP	AC	Str	EE-23	1¼	D-DD	No	No	No	Au	Yes	ACO	2¼		43
44	Packard Twelve	P	Y	Y	Y	Y		Y	G	30	20W	50–ND		10		Bay	Pur	Yes			Y	30	CP	AC	Str	EE-3	1½	D-DD	No	No	No	Au	Yes	AC	2¾		44
45	Pierce-Arrow 1701	P	Y	Y	Y	Y		Po	G	30	20W	45–40		9	Mot	Bay	Pur	Har	P	A-H	Y	30	CP	AC	Str	EE-3	1½	D-DD	No	No	No	Au	BS	AC	2½	Buf	45
46	Pierce-Arrow 1702	P	Y	Y	Y	Y		Po	G	30	20W	45–53	50	11	Mot	Bay	Pur	Har	P	A-H	Y	30	CP	AC	Str	EX-3	1½	2-SD	No	No	No	Au	BS	AC	2¾	Buf	46
47	Pierce-Arrow 1703	P	Y	Y	Y	Y		Po	G	30	20W	45–53	50	11	Mot	Bay	Pur	Har	P	A-H	Y	30	CP	AC	Str	EX-3	1½	2-SD	No	No	No	Au	BS	AC	2¾	Buf	47
48	Plymouth P-3	P	Y	Y	No	Y		Po	G	30	20W	35–40	42½	5		Bay	Yes†	No	P	A-H	Y	16	CP	AC	Car	BB	1¼	S-DD	No	No	No	Au	No	Bur			48
49	Plymouth P-4	P	Y	Y	No	Y		Po	G	30	20W	35–40	42½	5		Bay	Pur	No	P	A-H	Y	16	CP	AC	Car	BB	1¼	S-DD	No	No	No	Au	No	Bur			49
50	Pontiac De Luxe Six 37-26 CA	P	Y	Y	Y	Y		Po	G	30	20	35–40		6	AC	Bay	No	No	P		Y	18	CP	AC	Car	352-S	1¼	S-DD	No	No	No	Th	Car	AC	2	B-O	50
51	Pontiac De Luxe Eight 37-28 CA	P	Y	Y	Y	Y		Po	G	30	20	35–40		7	AC	Bay	No	No	P		Y	17	CP	AC	Car	350-S	1⅛	S-DD	No	No	No	Th	Car	AC	2	B-O	51
52	Studebaker Dict. & Dict. Pl. 6	P	Y	Y	No	Y		Po	SG	30	20	40–25	40	5½	Mot	Bay	Fram	No	P	Al	Y	18	CP	AC	Str	EX-23	1¼	S-DD	No	No	No	Au	Str	AC	2	Buf	52
53	Studebaker President	P	Y	Y	No	Y		Po	SG	30	20	40–25	40	8	Mot	Bay	Fram	No	P	Al	Y	18	CP	AC	Str	EE-1	1	D-DD	No	No	No	Au	Str	Bur	1¾	Bur	53
54	Terreplane 71	Sp	N	N	N	N		Sp	OP	30	10W	3–	3	5	None	No	No	No	P	A-H	Y	16.5	CP	AC	Car	348-S	1¼	S-DD	No	No	No	Man	No	AC	2	Old	54
55	Terreplane 72	Sp	N	N	N	N		Sp	OP	30	10W	3–	3	5	None	No	No	No	P	A-H	Y	16.5	CP	AC	Car	344-S	1	D-DD	No	No	No	Man	Car	AC	2	Old	55
56	Willys 37	P	Y	Y	N	Y		Po	G	30	20W	30–30	30	4	KS	Bay	No	No	P	A-H	Y	8.0	CP	AC	Tll	U-1-A	1⅛	S-DD	No	No	No	Man	No	AC	1⅝	Buf	56

•—30-2600 RPM
‡—Maximum †—At extra cost
2—Two Used
(a)—Stromberg—UU-3 or EE-3
ACO-AC—Oil Bath Type
AH—Alemite Hydraulic
Al—Alemite Au—Automatic

Bay—Bayonet
BB—Ball & Ball
Bij—Bijur
BO—Buffalo or Oldberg
B&S—Briggs & Stratton
BS—Bendix Stromberg
Buf—Buffalo

Bur—Burgess
Car—Carter
Cen—Central
CG—Chandler Groves
CP—Camshaft Pump
D-DD—Dual or Duplex Down Draft
DL—Detroit Lubricator

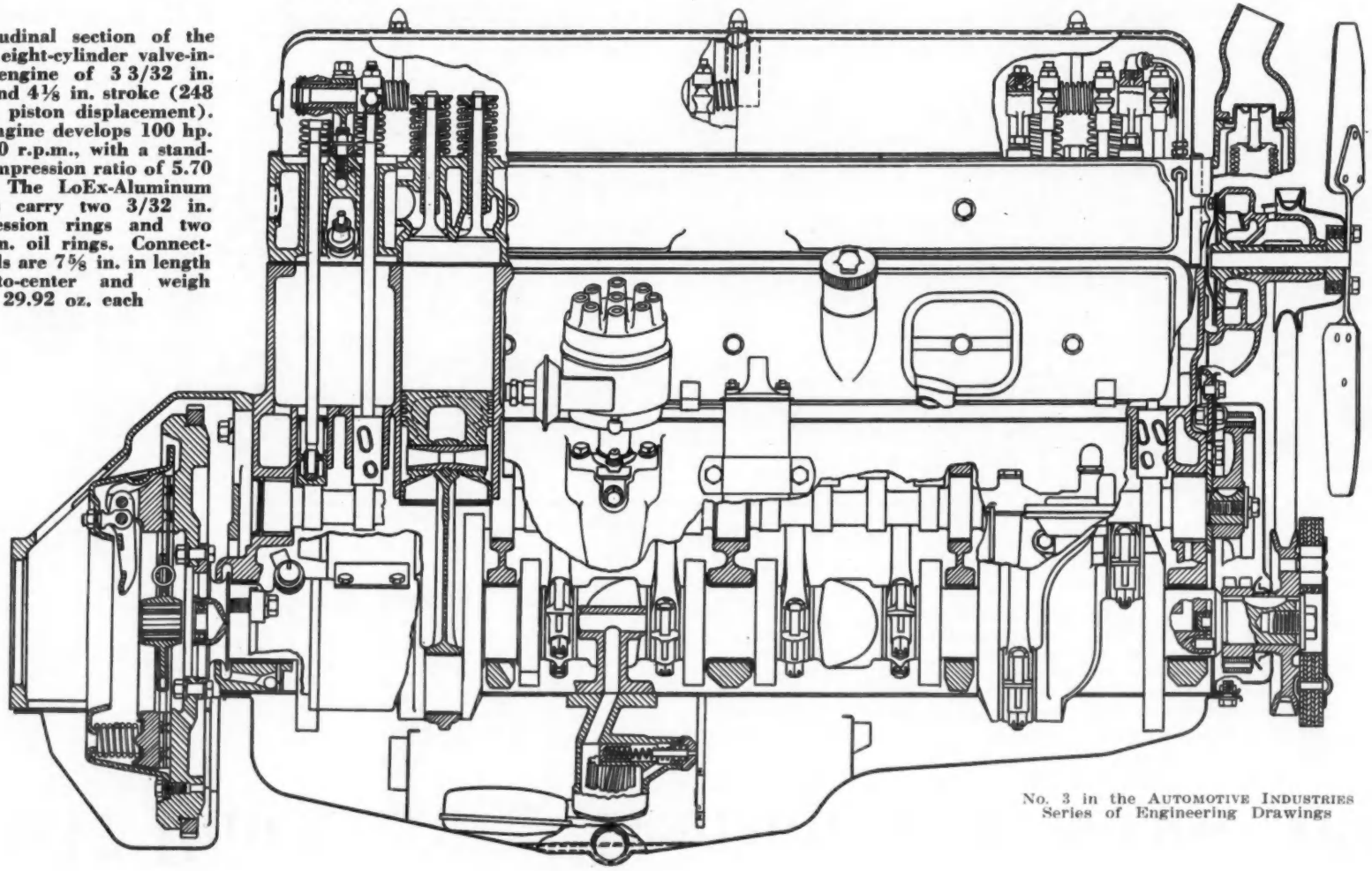
Fl—Float Type
G—Gear
G-Pf—Gear—Planetary friction Type
KS—King Seeley
Ln—Lincoln
MP—Mechanical Pump
Mot—Motometer Gauge & Equip. Co.

N—No
ND—Normal Driving
NS—Noblitt Sparks
OP—Oscillating Plunger
P—Pressure
Pf—Pines Winterfront Co.
Po—Positive

2-SD—Single Down Draft—2 used
S-DD—Single Downdraft
Str—Stromberg
SU—Single Updraft
SW—Stewart Warner
Var—Various
Wal—Walker

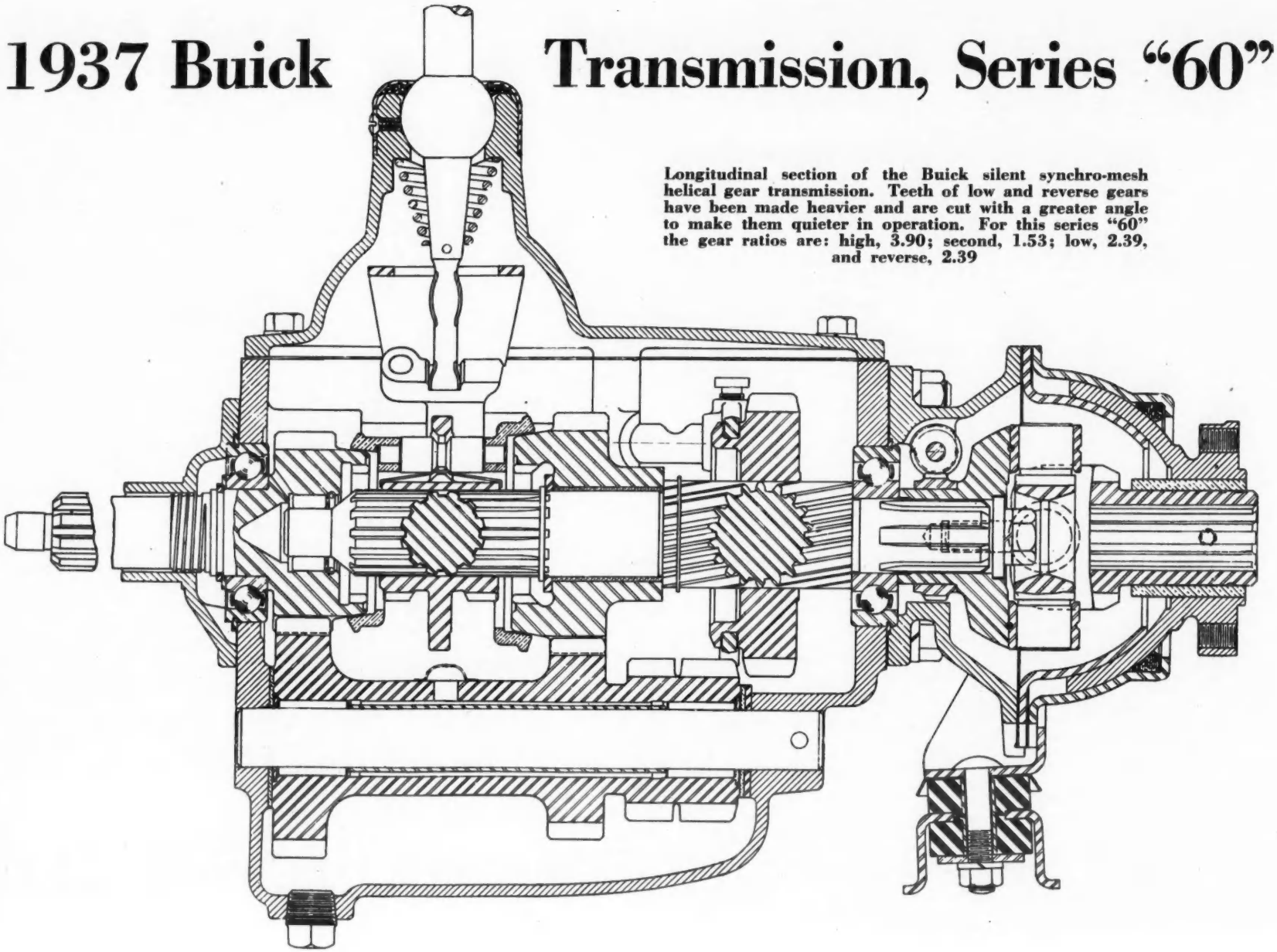
1937 Buick Engine, 8-Cylinder, Series "40"

Longitudinal section of the Buick eight-cylinder valve-in-head engine of 3 3/32 in. bore and 4⅛ in. stroke (248 cu. in. piston displacement). This engine develops 100 hp. at 3200 r.p.m., with a standard compression ratio of 5.70 to 1. The LoEx-Aluminum pistons carry two 3/32 in. compression rings and two 3/16 in. oil rings. Connecting rods are 7⅝ in. in length center-to-center and weigh 29.92 oz. each



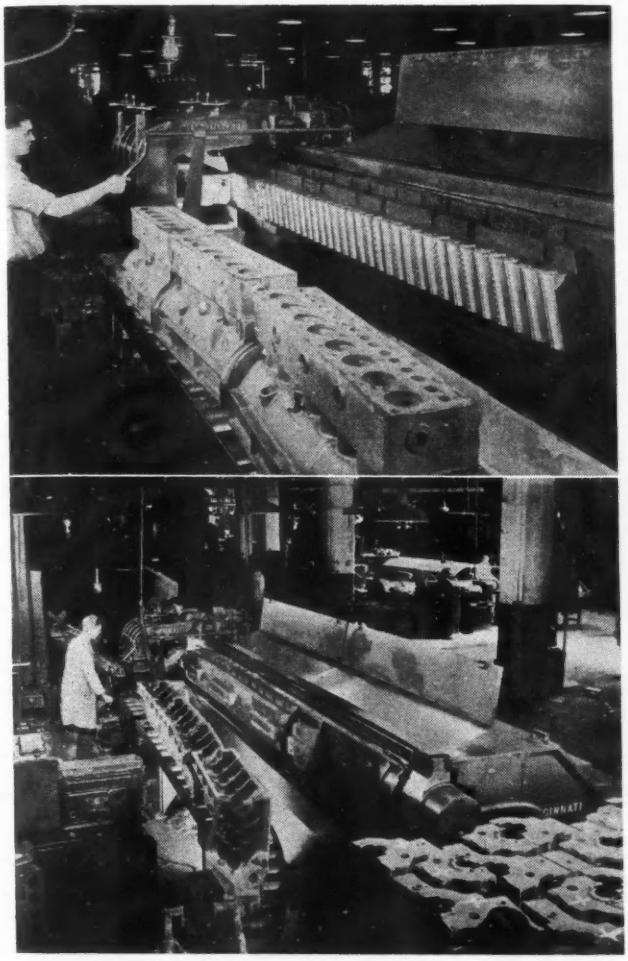
No. 3 in the AUTOMOTIVE INDUSTRIES Series of Engineering Drawings

1937 Buick Transmission, Series "60"



Longitudinal section of the Buick silent synchro-mesh helical gear transmission. Teeth of low and reverse gears have been made heavier and are cut with a greater angle to make them quieter in operation. For this series "60" the gear ratios are: high, 3.90; second, 1.53; low, 2.39, and reverse, 2.39

Production Lines



The accompanying illustrations show the two Cincinnati surface broaching machines which were installed by Packard during the change-over for the production of the Packard Six engine. Both the Packard Six and Packard 120 cylinder blocks are handled on these broaching machines.

This is the first example of regular production in which the large cylinder block areas are finished by broaching instead of milling. The machine at the left finishes the top of the cylinder block in one pass at the rate of one block per minute. The broach used for this operation has 41 inserted blades. The machine below finishes in one pass, the entire pan rail surface and bearing cap locks. The broach used for this operation has 96 inserted blades. The machines weigh 67,000 pounds each. Ram travel is 177 in. and surface speed of the broach is 35 f.p.m.

Making Shocks

During our recent visit to Dayton we had an opportunity to see some of the machining operations on the 1937 Delco line of double-acting and direct-acting shock absorbers. Much of the special multiple-spindle drilling equipment was designed and built by the company, an interesting feature being the direct drive electric motors with aluminum housings to promote better cooling. The machine shop line is replete with centerless grinding operations, particularly batteries of two or more centerless machines direct connected by suitable magazine devices. For the production of the direct-acting shocks Delco has set up a special roll forming machine with an automatic head which turns out the cylindrical housing from strip stock.

Quick Balance

Airtemp, Inc., makers of air conditioning equipment in Dayton has just installed the slickest balancing device we have ever seen. This is a new automatic balancing machine developed by Gisholt, called the Dynetric Balancer, and is being used for dynamic balance of rotors and shafts. In this device the work is set up on sensitive floating centers and the exact amount of unbalance in grams read directly from a scale. The location of the unbalance at both ends is found by pointing a stroboscope which indicates the location by spotting a number marked on a disk. Correction is made by applying the right amount of solder and the setting again checked by stroboscope and indicator while the work is in the machine.

Auto Shows

Habits have changed with the times at the automobile shows. Not so long ago, it was necessary to lift hoods and crawl under the chassis to find some special feature. And in fact, everybody was lifting hoods in every corner of the place. Today each car builder has his own stripped and cut away chassis display with a well-informed "elucidator." In addition, many of the cars feature special displays of engine and chassis features in various forms. Chevrolet has an elaborate cabinet display of chassis units in action. Hudson has an interesting set-up in which the public can experience the handling of Electric Hand shifting including a cut away transmission showing how the elements function. Having progressed this far, the exhibitor can tell his story much quicker and with more telling effect.

Powder Metallurgy

It was quite an experience to pay a brief visit to Moraine Products in Dayton, makers of self-oiling plain bearings. The interesting thing about these bearings is the fact that they are pressed into desired form under high pressures using the bearing alloy in powder form. No machining is required since the most intricate forms can be developed in the die within any specified commercial tolerances. After heat treatment, the bearings are sized and coined on another battery of presses.

—J. G.

MANUFACTURING MANAGEMENT METALLURGY

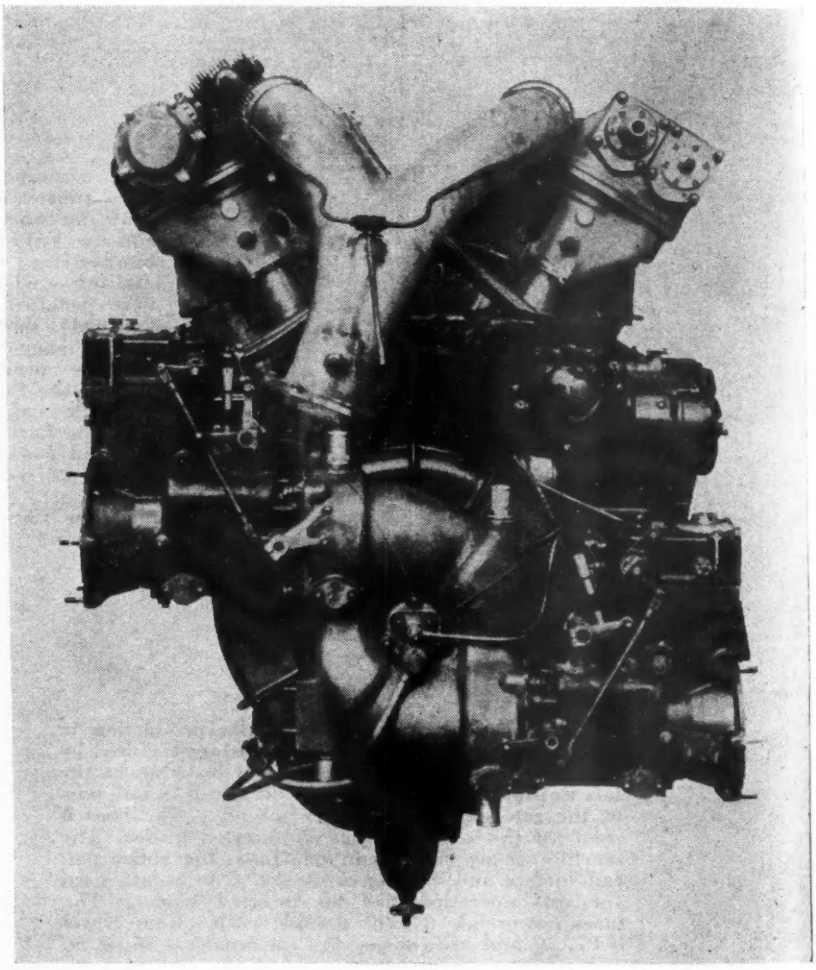
French Aviation Show a Display

AIR-COOLING is the outstanding feature of the engine section of the 15th French aviation show, held in the Grand Palais, Paris. Compared with the last show, held two years ago, the change from liquid cooling to direct air-cooling is remarkable, and this change has not been made to the benefit of the radial-type engine, but to the in-line type, with either one bank or two banks of cylinders in inverted V formation.

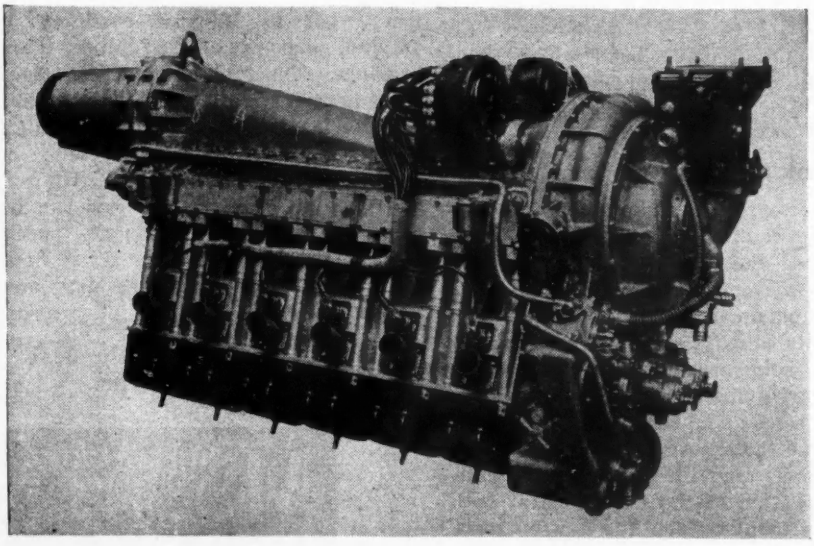
Renault, one of the biggest producers in France, has dropped liquid-cooled models and while retaining his four radial air-cooled jobs, has added in-line air-cooled engines, with four, six and twelve cylinders, varying from 100 to 450 hp.

A similar move has been made by Salmson, this firm now having inverted sixes and twelves. Lorraine's latest model is an air-cooled horizontally opposed 12-cylinder model, built under Potez license. Walter of Prague also has the same type of engine as the latest model.

With a total of 166 exhibitors, there are 18 firms in the engine section, 12 of these being French, three English, and one each representing Russia, America and Czechoslovakia. Undoubtedly the finest show the French have ever staged and one revealing immense technical progress, this Salon is far from being



(Above) Lorraine Dietrich 810 hp. water cooled engine. Note the rotary movement of mixture to the two banks of cylinders



(Left) Renault inverted 12 cyl. air-cooled 450 hp. engine

# of Technical Development

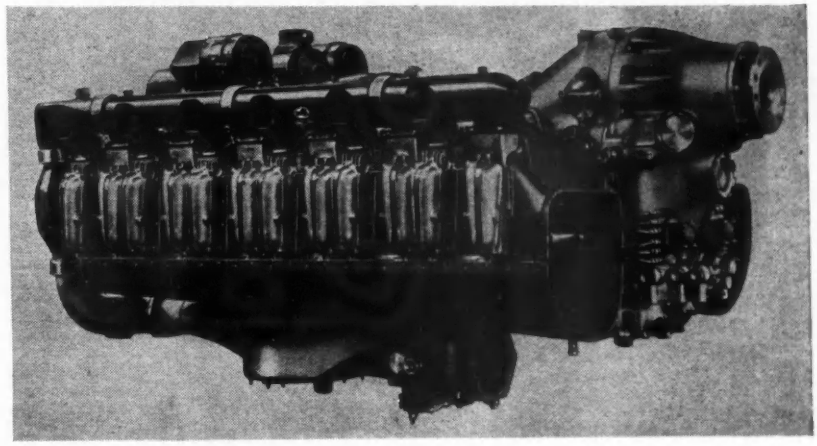
Greater progress has been made during the two years since the last exhibit than during the previous ten years

By W. F. Bradley

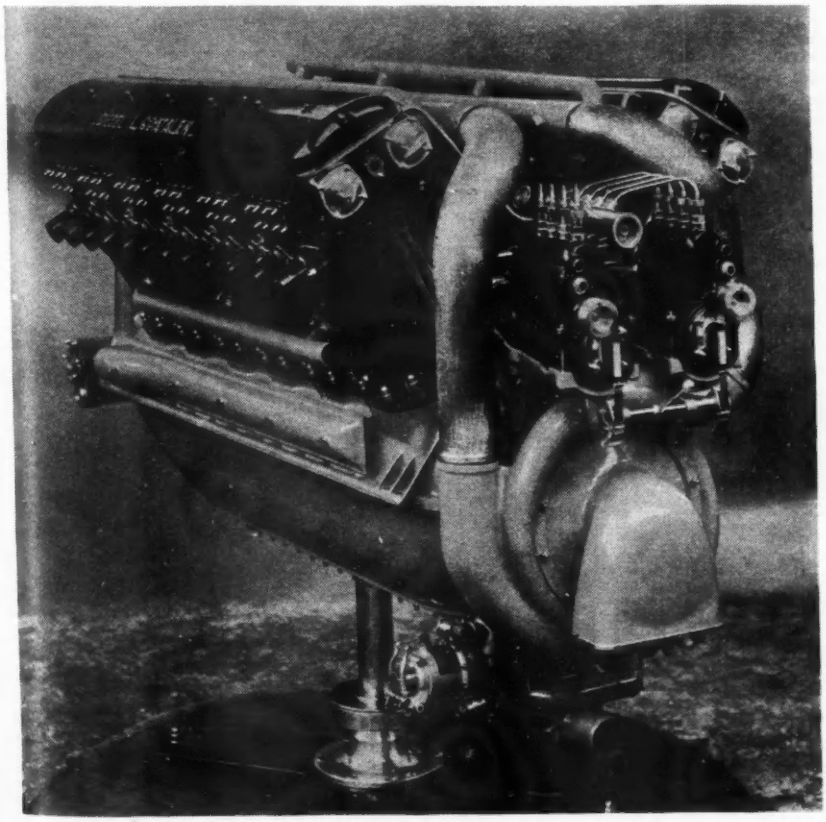
international. Germany and Italy are conspicuous by their absence. There are no American planes on view, and the only American engines are those built by the Curtis-Wright Corporation. The British industry is inadequately represented by the three engine manufacturers, Rolls-Royce, Armstrong-Siddeley, and Bristol.

The atmosphere of the show is entirely military, and in view of the secrecy usually displayed and the suspicion which is generally cast on any person asking for technical information, it is somewhat surprising to find the latest types of planes and the most up-to-date designs of engines, some of which are not yet in production, available for detailed examination. In view of the military tone it is really not surprising to find the British Hawker stand empty. A notice indicates that the firm intended to show its Hurricane model, but that at the last moment the Air Ministry refused its permission.

Apparently the only non-military plane at the show is a new Farman 40-passenger liner built for Air France, but even this is a derivative of a bomber. It is true that there are a number of light, private planes, but there are no indications that they are being sold or



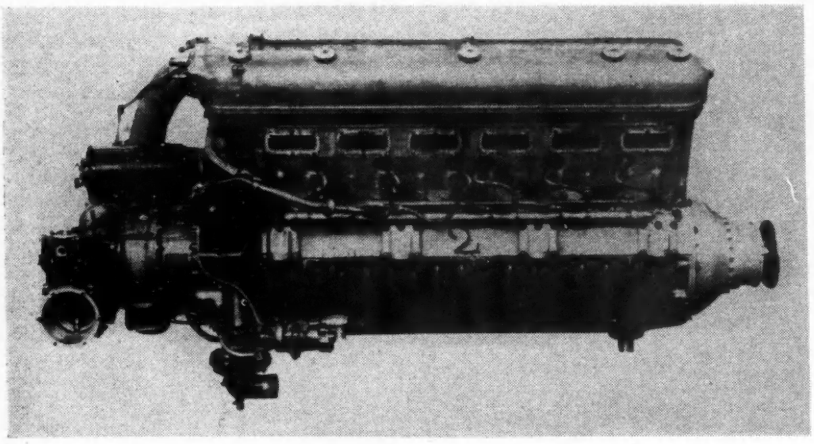
(Above) Lorraine 12 cyl. opposed air-cooled engine of 450 hp. with reduction gear



(Left) Louis Gotalen supercharged aircraft Diesel seen from the blower end

that their sponsors are in position to produce them if orders were received. One of the difficulties is the unsettled state of the market, which makes it almost impossible to estimate production costs three months hence.

The educational and propaganda value of this show is very high, with displays by the Air Ministry, the Army and Navy, technical schools, flying schools and air transport companies of real interest. Groups of school children, students, soldiers and members of technical institutes are conducted through the show daily under the guidance of competent instructors.



During the past two years more progress has been made by French manufacturers of both engines and planes than in ten years of normal development. The complete triumph of the monoplane, all-metal construction, retractable landing gears, increased speed, higher ceiling, and wider range of action are the results obtained. Two years ago France lagged behind in design and construction; today she stands in the forefront.

Renault's latest production is a 450-hp. inverted 12-cylinder air-cooled engine of 120 by 140-mm. bore and stroke (1159 cu. in. piston displacement). This engine has steel cylinders, alloy heads, push-rod-operated valves, and a centrifugal blower drawing from a Zenith carburetor. The compression ratio is 6.4 to 1, and the power output of 450 hp. is obtained at 2500 r.p.m. The weight, empty, is 833 lb. and with generator, pumps, propeller hub, starter, oil and anti-backfire device the weight is brought up to 924 lb.

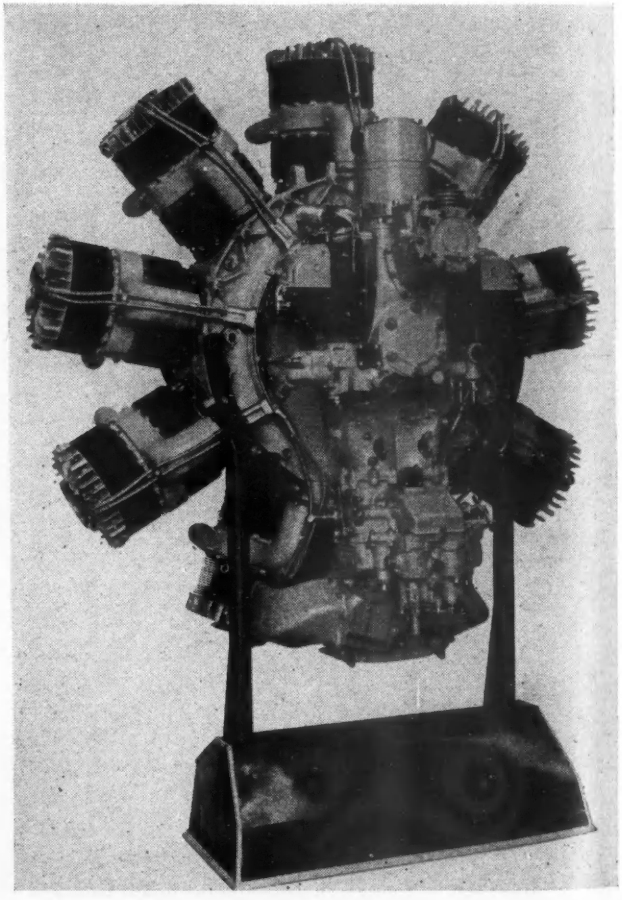
The engine with which Detroyat won the Thompson Trophy in America this year is an inverted air-cooled six of 8 liters (488 cu. in.) piston displacement, having a centrifugal blower, and developing 325 hp. at 3000 r.p.m.

Salmson has the same general program as Renault, with a 12-cylinder, 8-liter model known as the Deutsch-Cup type, and the high speed, 12-cylinder inverted V.A.R.S. of 13.68 liters (840 cu. in.), turning at 3800 r.p.m. for a propeller speed of 2153 r.p.m. Its nominal horsepower up to 13,500 ft. is 450, while its maximum speed, corresponding to a power output of 500, is 3950 r.p.m. One of the features of this engine is the use of two overhead camshafts, the drive being by bevel gearing to a vertical shaft, this operating a short cross-shaft with helical gearing to the two camshafts. The weight is given as 792 lb. with magnetos, carburetor, plugs, compressor, but without gasoline pumps, propeller hub, exhaust manifold, starter or electric generator.

Presented by the Walter Company of Prague is another 12-cylinder, inverted, air-cooled engine. It has a bore and stroke of 118 by 140 mm. (4.65 by 5.51 in.), a piston displacement of 18.37 liters (1120 cu. in.), a compression ratio of 5.5, a normal speed of 2400 r.p.m. and a horsepower of 460. The same firm has a series of four and six-cylinder inverted engines, with and without supercharger.

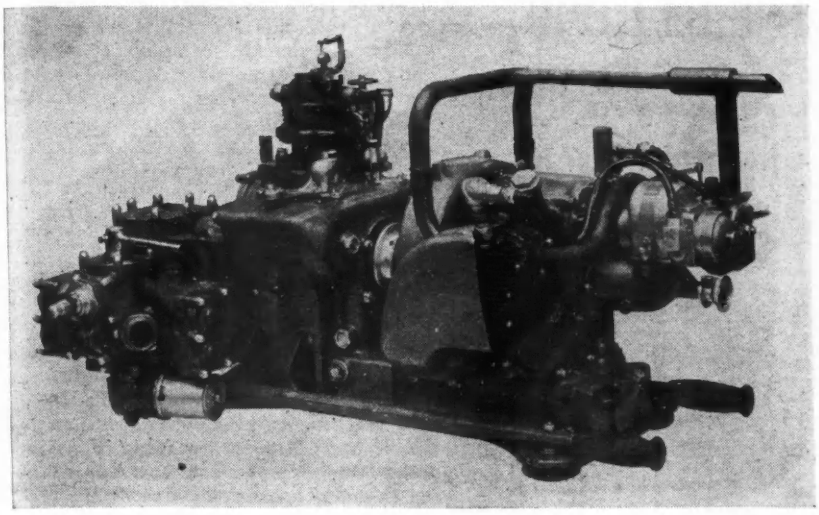
Regnier is another make specializing in inverted air-cooled fours and sixes, of the pushrod type, with centrifugal blower and direct-driven propeller.

A very interesting flat twelve, air-cooled engine has been produced by Lorraine, under Potez license. The dominating idea in this layout has been reduced frontal area, together with maximum accessibility. The nitralloy cylinders have light alloy heads with two valves operated by pushrods and enclosed rockers. Cylinder dimensions are 125 by 120 mm. (4.92 by 4.73 in.), which makes the piston displacement 1073 cu. in. Its compression ratio is 6.5 and its power output 475 hp. at 2500 r.p.m. This corresponds to a propeller speed of 2000 r.p.m. The cylinders are directly opposed and are held to the magnesium crankcase by bolts passing right

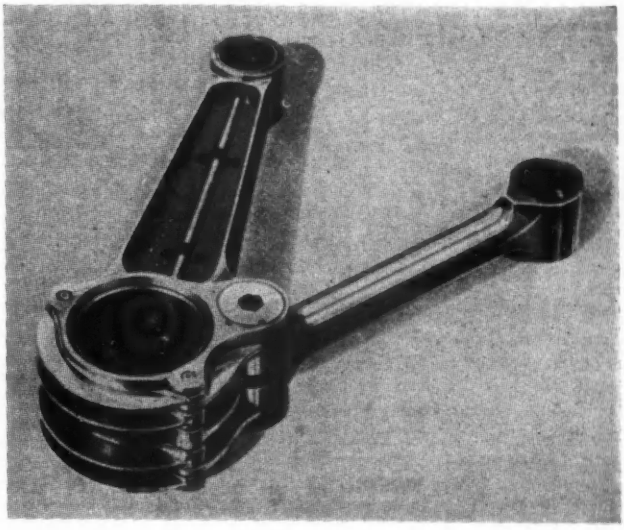


(Above) Lorraine Dietrich 810 hp. water-cooled engine with planetary reducing gear "Sterna"

(Right) Bristol "Perseus" single-sleeve-valve engine



(Above) Potez auxiliary set with two cyl. engine driving electric generator, air compressor and pumps



(Right) Hispano Suiza rod assembly

through each pair. There is one main connecting rod and an auxiliary rod.

It is with a view to accessibility and reduced area that the centrifugal blower, turning at nine times engine speed, is mounted beneath the engine. This renders it accessible by removing the under cowling. There are two magnetos and an electric generator on top of the crankcase. Plugs are on opposite sides of the cylinder barrels and accessible by removing the upper or the lower cowling. Oil pumps, oil filter and compressed air distributor are on the forward face of the engine, just behind the propeller; on the rear face are the air compressor and pumps for fuel and operation of landing gear. The mixture is delivered through two intake manifolds running above each bank of cylinders, just above the exhaust outlets, and on the vertical branch of each manifold there is incorporated an anti-backfire device.

Practically every maker has one or more models of radial air-cooled engines, but those producing this type only are Armstrong-Siddeley, with 7 and 14-cylinder models; Bristol, with both poppet and sleeve valve models; and Gnome & Rhone. The most powerful radial in the show is the Gnome & Rhone 18-cylinder, in two banks of nine, which has developed 1500 hp. at 13,000 ft. Among the changes made are the use of nitralloy steel for the cylinder barrels, with cooling fins brought right down to the studs, an alloy head with very thin and closely placed fins giving a reduction in temperature of 30 to 40 degrees compared with previous models, and light alloy pistons with a honeycomb cooler on the inner face of the head. The present engine speed is 3000 r.p.m., but it is expected that this will shortly be exceeded. Two-stage superchargers are used, which restore seat-level output at 6500 and 13,000 ft. respectively. Three-blade metal propellers, adjustable for pitch on the ground, in the air, or automatically adjustable in flight, have been developed.

Two years ago Bristol presented a single - sleeve - valve radial air - cooled model. In the interval this type has been considerably developed, and is now made in two models, the Persius, of 679 hp., and the Aquila, of 426 hp. Experience has shown that its advantage over the poppet valve model is a 10 per cent fuel economy and reduced maintenance charges, the intervals between top overhauls being 600 hr. It appears to be the belief that the sleeve-valve type will eventually replace the poppet valve models for commercial service, where fuel and maintenance economy are important, and also for the wide-range bomber-type of plane.

There is no change in Hispano Suiza policy, this firm now having four main types of radial air-cooled engines and the same number of liquid-cooled 12-cylinder models. The main argument put forward in favor of the liquid-cooled models is reduced head resistance compared with the radial. This, of course, does not apply when compared with the in-line air-cooled job, and apparently it is experience in speed contests, where the in-line jobs have always beaten the radials, that is largely responsible for the new tendency seen at the Paris show. In the matter of weight it is claimed that there is no difference; when considering weight in terms of range of action, the advantage is with the liquid-cooled jobs; the temperature of the engine is easily controllable, visibility is better, and there is greater accessibility in flight.

Hispano Suiza appears to be the only firm in the show placing the carburetors (three for each bank of six cylinders) after the blower. The advantage claimed for this is that the air is warmed by compression and all danger of freezing carburetors is avoided. Nitralloy steel barrels are used, these being screwed into the aluminum alloy head and closed at the base by a rubber joint which permits of longitudinal expansion. The outer wall of the cylinder barrel is rust-proofed by a deposit of cadmium. The feature of the rod construction is an I-section for the main rod and tubular section for the companion rod. The cap is deeply ribbed for cooling and instead of bolts the two parts of the big end are united by taper pins. Valve stems are sodium-filled and all the 12-cylinder models have geared-down propellers with variable-pitch gear.

Rolls-Royce shows three water-cooled models, the latest type being a 12-cylinder of 1065 hp. The only Russian engine on view is a water-cooled twelve, manu-

(Turn to page 802, please)

Sales of 1936 Models 3,311,090

First 10 Months of Year Show Registration Gain of 24.8%; GM Group Holds Lead, Followed by Chrysler

New Passenger Car Registrations

	October 1936	Sept. 1936	October 1935	Ten Months 1936	Ten Months 1935	Per Cent Change, 10 Mos., 1936 over 1935	Per Cent of Total Ten Months 1936	Per Cent of Total Ten Months 1935	November 1935 through October 1936
Chevrolet	28,241	55,946	34,869	786,604	535,534	+ 47.0	27.57	23.42	907,768
Ford	45,710	54,726	38,311	657,493	715,347	− 8.0	23.04	31.29	766,665
Plymouth	30,332	29,326	16,518	410,177	320,133	+ 28.1	14.37	14.00	473,029
Dodge	14,776	15,257	7,719	206,280	145,894	+ 41.2	7.23	6.38	239,156
Oldsmobile	3,942	8,837	7,807	154,170	121,807	+ 26.8	5.40	5.33	181,738
Pontiac	6,757	9,335	8,037	139,570	117,702	+ 18.7	4.89	5.15	161,990
Buick	8,688	5,454	12,760	123,002	62,732	+ 96.1	4.31	2.74	147,905
Terraplane	3,421	4,257	2,179	64,893	43,839	+ 48.1	2.27	1.92	74,892
Studebaker	7,202	4,808	2,575	55,532	33,607	+ 65.2	1.95	1.47	61,498
Packard	8,453	6,131	4,970	54,280	29,000	+ 87.2	1.90	1.27	62,933
Chrysler	2,550	3,216	1,535	46,377	35,856	+ 29.3	1.63	1.57	51,057
De Soto	2,417	2,712	1,847	35,923	23,193	+ 55.5	1.26	1.01	39,682
Nash-La Fayette	2,134	2,119	2,705	34,668	29,910	+ 16.0	1.22	1.31	39,942
Hudson	957	1,003	1,030	17,459	17,419	None	.61	.76	21,627
Graham	1,059	1,096	1,290	13,901	14,133	− 1.6	.49	.62	15,733
Lincoln	1,778	1,122	106	11,804	1,398	+745.0	.41	.06	12,776
Willys	968	1,003	744	10,741	8,228	+ 30.8	.38	.36	12,952
La Salle	503	879	1,038	9,520	9,583	− 0.5	.33	.42	11,712
Cadillac	613	795	781	9,413	4,507	+109.0	.33	.20	11,598
Reo	203	215	288	2,942	3,372	− 12.7	.10	.15	3,464
Auburn	83	92	358	1,713	4,655	− 63.1	.06	.20	2,221
Hupmobile	19	32	426	1,534	6,607	− 76.8	.05	.29	2,377
Cord	91	89	.....	1,036	.....	.....	.04	.....	1,036
Pierce-Arrow	62	67	108	687	723	− 5.0	.02	.03	839
Miscellaneous	360	379	588	3,915	1,273	+207.0	.14	.05	4,500
Total	171,319	208,896	148,389	2,853,634	2,286,452	+ 24.8	100.00	100.00	3,311,090
Chrysler Corp.	50,075	50,511	27,419	698,757	525,076	+ 33.0	24.49	22.96	802,924
Ford and Lincoln	47,488	55,848	38,417	669,297	716,745	− 6.6	23.45	31.35	781,441
General Motors	48,744	81,246	85,292	1,222,279	851,865	+ 43.6	42.83	37.25	1,422,711
All Others	25,012	21,291	17,261	263,301	192,766	+ 36.6	9.23	8.44	304,014

New Truck Registrations

	October 1936	Sept. 1936	October 1935	Ten Months 1936	Ten Months 1935	Per Cent Change, 10 Mos., 1936 over 1935	Numerical Change, 10 Mos., 1936 over 1935	Per Cent of Total Ten Months 1936	Per Cent of Total Ten Months 1935
Chevrolet	7,947	15,589	9,150	179,444	143,779	+24.9	35,665	33.28	33.09
Ford	11,666	17,044	12,362	160,169	157,893	+ 1.4	2,276	29.70	36.34
Dodge	7,541	7,957	6,822	75,567	52,212	+44.8	23,355	14.01	12.02
International	6,642	6,640	5,350	61,429	45,283	+35.7	16,146	11.39	10.42
G. M. C.	2,788	3,209	907	23,903	9,315	+157.0	14,588	4.43	2.14
Diamond T	987	826	557	7,297	5,563	+31.2	1,734	1.35	1.28
White	616	510	381	4,789	2,600	+84.1	2,189	.89	.60
Reo	529	521	412	3,677	4,277	−14.1	−600	.68	.98
Mack	509	424	136	3,396	1,237	+175.0	2,159	.63	.28
Studebaker	347	327	209	2,858	1,864	+53.3	994	.53	.43
Federal	260	244	198	2,466	1,760	+40.2	706	.46	.41
Plymouth	85	166	43	2,338	505	+363.0	1,833	.43	.12
Willys-Overland	253	251	218	2,134	1,881	+13.4	253	.40	.43
Terraplane	59	141	33	1,661	609	+173.0	1,052	.31	.14
Brockway	155	138	129	1,456	1,018	+43.0	438	.27	.23
Indiana	194	135	163	1,445	628	+130.0	817	.27	.14
Autocar	160	124	92	1,106	755	+46.4	351	.21	.17
Stewart	135	141	94	1,095	690	+58.8	405	.20	.16
Divco	88	63	37	840	289	+191.0	551	.16	.07
F. W. D.	22	13	11	287	165	+74.0	122	.05	.04
Sterling	38	17	17	210	140	+50.0	70	.04	.03
Twin-Coach	.....	3	16	87	124	−29.8	−37	.02	.03
Miscellaneous	186	128	102	1,563	1,903	−17.6	−340	.29	.45
Total	41,207	54,611	37,439	539,217	434,490	+24.2	104,727	100.00	100.00

Flying Laboratory Used By Dept. of Commerce

An air transport-type airplane equipped with all of the newest air navigation features and safety devices which are in use in scheduled air transportation has just been delivered to the Bureau of Air Commerce, Eugene L. Vidal, director of air commerce, has announced. The plane will be used by bureau air line inspectors in their work of examining air-line pilots and checking air lines; for development on air-line equipment, particularly as aids to air navigation; and for blind approach testing.

Known as the Lockheed 12A, the airplane was designed on the basis of Department of Commerce specifications so written as to produce a craft which not only would meet the need for an airplane for air-line inspectors and for development work, but also would provide a new type for "feeder" air-line service. It is a low-wing monoplane of all-metal construction, with a wing span of 49½ ft., and powered with two Pratt & Whitney Wasp Junior engines of 450 hp. each. Cruising speed is 213 m.p.h.; cruising range, 1000 miles, with pilot, co-pilot and four passengers.

The craft has the following special safety equipment: complete two-way radio; a radio compass; de-icing "overshoes" on the leading edges of the wings and stabilizers; propeller de-icers; constant speed propellers; automatic pilot and radio antennas so mounted as to keep them free of ice.

City of Pontiac Greets GM, Fisher Officials

Officials of General Motors Corp. and its Fisher Body division were guests of honor Dec. 2, at a luncheon in the Pantlind Hotel at Grand Rapids. The occasion was the city's official welcome to the Grand Rapids stamping division, opened this summer and now approaching capacity operations with 2000 workers employed. The new $7,000,000 plant is operated by the Fisher Body division of the corporation.

Approximately 300 representatives of the city's business, civic and industrial interests attended the luncheon. Harry M. Taliaferro, president of the American Seating Co., was chairman of the civic committee in charge of plans. Responses to the welcome were given by Alfred P. Sloan, Jr., president of General Motors, W. S. Knudsen, executive vice-president, and Edward F. Fisher, general manager of the Fisher Body division.

During the afternoon all the luncheon guests inspected the new plant, which again on Saturday held open house to employes and the general public.

Employment at Ford Parts Plant Back to 1929 Level

Approximately 1000 persons will be added to the Ford Motor Co.'s Green Island, N. Y. plant, in which bearings, radiators and springs are produced, when it goes on a 24-hr. operating schedule for the first time since 1929. The plant had long been carrying a skeleton staff of 300 workers, but several weeks ago this number was doubled to meet demands for new cars.

Two electric tempering furnaces costing $22,000 and an automatic device to inspect roller bearings are being installed. Monthly production of bearings has been set at 6,000,000. Daily production schedules, beginning Dec. 1, call for 2400 sets of passenger car springs, 1200 radiators, 13,000 wheel bearings, 7000 drive shaft bearings, 3000 transmission bearings, and 500 truck front springs.

October Retail Financing 32% Higher than Year Ago

The dollar volume of retail financing of new passenger automobiles shows an increase of 32 per cent for the month of October as compared with October, 1935, and an increase of 33 per cent compared with October, 1934, according to preliminary estimates made by the

Department of Commerce. As compared with September, 1936, there was a decrease of 33 per cent.

The aggregate volume for the first 10 months of this year was 57 per cent above the first 10 months of 1935 and 80½ per cent higher than for the corresponding period in 1934.

Walsh-Healey Evasions Checked

(Continued from page 764)

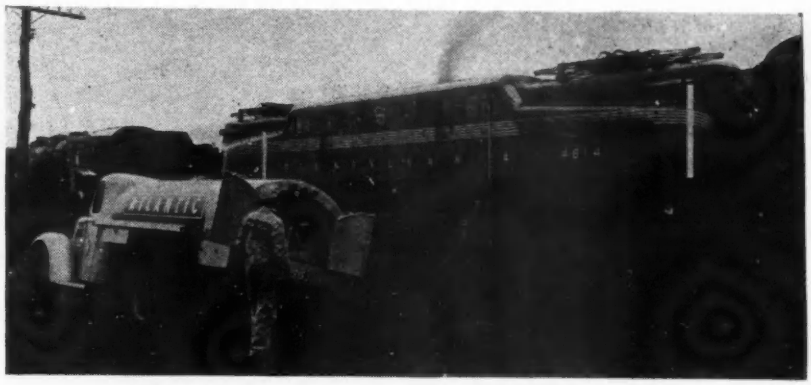
but to check a practice which has been reported recently by various contracting agencies under which dealers, instead of furnishing goods from stock, have been placing orders with factories which are not conforming to the labor conditions of the law and having such factories ship their products direct to the government. As a result of this practice, she said, there have been some instances where manufacturers, submitting proposals in their own name and thereby expressly agreeing to the stipulations required under the act, have been placed at a competitive disadvantage.

"While it is true that the act permits dealers having goods on hand to fill government orders out of their own stock it is clearly contrary to the intent of Congress that a dealer, acting merely as a broker, should select factories which are not complying with the act," said Secretary Perkins.

"Under this regulation bids will still be received from dealers but the government will look to manufacturers who are supplying goods in accordance with a government order, to carry out the representations as to labor conditions regardless of whether or not they actually signed the proposals."

The Department of Labor keeps a record of concerns which have been awarded contracts under the Walsh-Healey Act and is making the lists public in bulletins which are issued from time to time. Among such contractors so far listed are:

American-Hawaiian Motors Co., Ltd., Honolulu, T. H., 20 Dodge trucks, $21,288.50, for Procurement Division, Treasury Department; Hall-Aluminum Aircraft Corp., Bristol, Pa., six flying boats and equipment, $709,852, for Coast Guard; Seversky Aircraft Corp., Long Island City, N. Y., airplane parts, $16,878.74, for War Department; Winton Engine Corp., Cleveland, parts for Winton engines, $14,885.49, for Navy Department; Four Wheel Drive Auto Co., Clintonville, Wis., four dump trucks and equipment, $19,261.38, for Interior Department.



Electric locomotives have to be refueled—in cold weather at least. During the Army-Navy football game at Philadelphia, fuel oil for heating the 24 waiting trains was delivered by four 1000-gal. tank trucks.

Passenger Car Production by Wholesale Price Classes

(U. S. and Canada)

First Ten Months 1936 and 1935 Compared

	1936	1935	Per Cent Change	Per Cent of Total 1936	Per Cent of Total 1935
Under $500	1,642,829	1,592,294	+ 3.2	54.52	59.27
$501-$750	1,233,470	977,037	+26.2	40.93	36.37
$751-$1000	94,217	81,921	+15.0	3.13	3.05
$1001-$1500	30,265	21,594	+40.0	1.00	.80
$1501-$2000	8,663	7,187	+20.5	.29	.27
$2001-$3000	3,561	4,237	−15.8	.12	.16
$3001 and over	263	2,018	−87.1	.01	.08
Total	3,013,268	2,686,288	+12.1	100.00	100.00

Truck Production by Capacities

(U. S. and Canada)

First Ten Months 1936 and 1935 Compared

	1936	1935	Per Cent Change	Per Cent of Total 1936	Per Cent of Total 1935
1½ tons and less	631,229	567,966	+11.1	93.00	93.62
2 to 3 tons	33,576	29,517	+13.6	4.95	4.87
3½ tons and over	7,102	5,170	+37.0	1.05	.85
Special and buses	6,848	4,003	+71.2	1.00	.66
Total	678,755	606,656	+11.9	100.00	100.00

Outlook Good for Canadian Exports

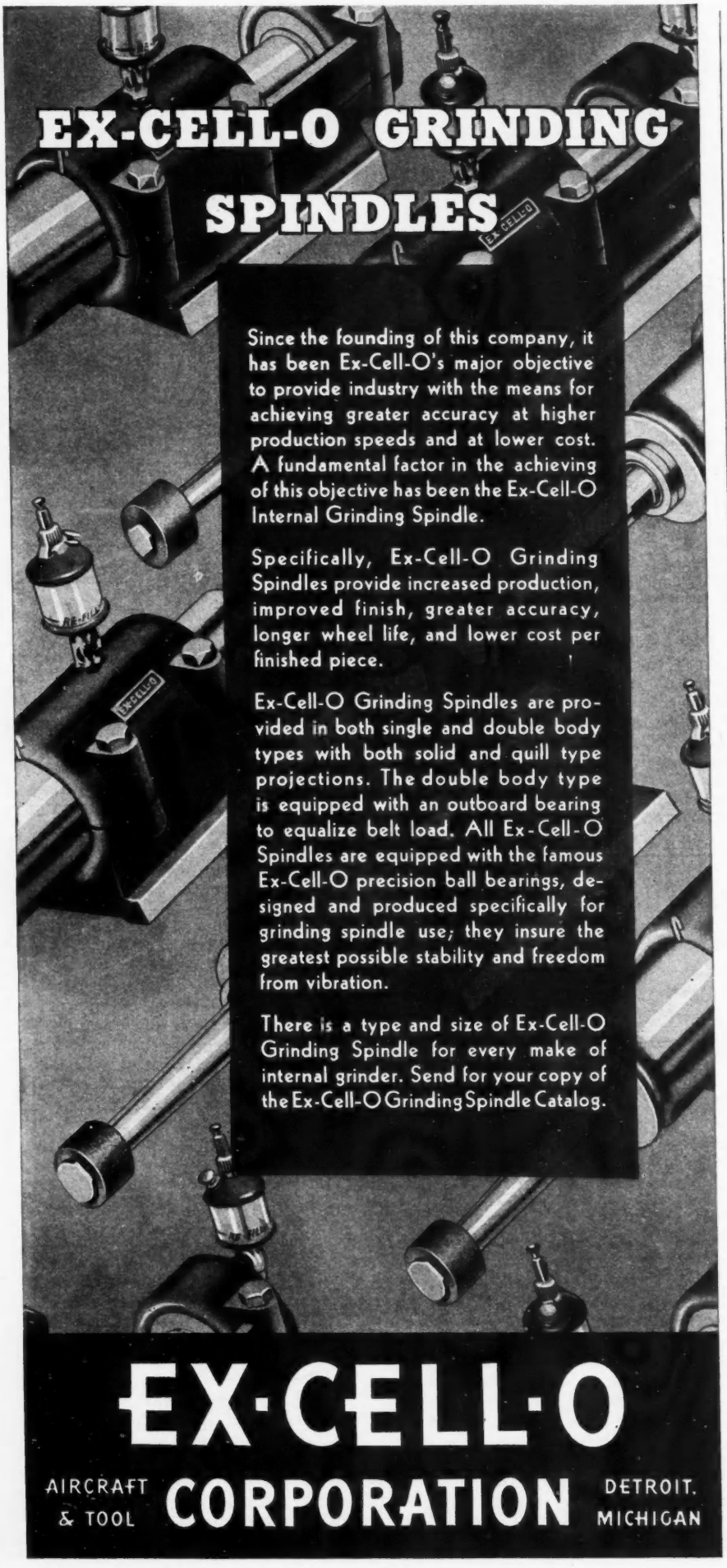
Though export sales of Canadian made automobiles have been lower in recent months than a year ago, prospects for the coming season are considered excellent by leading firms. The current falling off in demand is attributed to seasonal slackness and to an earlier "change-over" in many lines than a year ago. Canadian exports of automobiles and automobile parts for the first 10 months of the 1936 "season" are 11 per cent above corresponding figures last year. The "season" is calculated from Nov. 1. On this basis, total exports to the end of August were $39,300,000 compared with $35,300,000 in the same period last year.

General Motors of Canada expect export sales will be 25 to 30 per cent ahead of last year due to better prospects for marketing Chevrolet and McLaughlin-Buicks in the United Kingdom and to the fact that the New Zealand market is open for the first time in several years due to ability of the company to meet Empire content requirements. All companies are still worried about prospective sales to Australia due to the quota set up in that country's last budget.

One interesting but unconfirmed rumor points to additional exports from Canada to England and the Empire will be due to armament activity in British plants which has reduced their ability to supply their customary home and export markets.

Simmons Moves to Ashland, O.

The Simmons Manufacturing Co., makers of automotive parts and equipment, is now operating in two new plants in Ashland, Ohio, having moved there from Cleveland. The company has also established a new factory branch in Chicago.


EX-CELL-O GRINDING SPINDLES
Since the founding of this company, it has been Ex-Cell-O's major objective to provide industry with the means for achieving greater accuracy at higher production speeds and at lower cost. A fundamental factor in the achieving of this objective has been the Ex-Cell-O Internal Grinding Spindle.
Specifically, Ex-Cell-O Grinding Spindles provide increased production, improved finish, greater accuracy, longer wheel life, and lower cost per finished piece.
Ex-Cell-O Grinding Spindles are provided in both single and double body types with both solid and quill type projections. The double body type is equipped with an outboard bearing to equalize belt load. All Ex-Cell-O Spindles are equipped with the famous Ex-Cell-O precision ball bearings, designed and produced specifically for grinding spindle use; they insure the greatest possible stability and freedom from vibration.
There is a type and size of Ex-Cell-O Grinding Spindle for every make of internal grinder. Send for your copy of the Ex-Cell-O Grinding Spindle Catalog.
EX-CELL-O
AIRCRAFT & TOOL CORPORATION DETROIT, MICHIGAN

Automotive Metal Markets

(Continued from page 767)

wire, which was lifted $2 a ton, with the understanding on the part of some of the producers that the new price was to apply to January shipments only.

Pig Iron—Following record-breaking shipments in some of the Middle West markets, routine conditions are beginning to set in. In the Chicago market sales at a $1 per ton advance are reported to have been made on the basis of $20.50 for No. 2 foundry. Lake navigation is becoming more problematical with the advancing season.

Aluminum—Announcement by the sole domestic producer that mutually satisfactory revision of working conditions had been arrived at in conferences with union representatives is indicative of a continuance of stable conditions in the industry. The market remains entirely unchanged. Latest statistics of imports disclose these are running very much as they did last year. The market for secondary metal is steady.

Copper—Producers' sales in November aggregated around 88,000 tons. Speculation abroad appears to have abated, the export price being fractionally lower. Automotive demand for copper and brass products is well maintained. The price for electrolytic copper is unchanged at 10½ cents.

Tin—The metal's statistical position is somewhat more favorable to consumers, a sharp increase in shipments from the East and in world visible supplies being noted. At the beginning of the week spot Straits tin was offered at 51⅞ cents, about ¾ cents lower than at the preceding week's close.

Lead—Firm.

Zinc—Unchanged.

Pedrick-Hydraulic Rings For McCormick Tractors

Wilkening Manufacturing Co. has been awarded a contract by International Harvester Co. of America, Inc., to supply Pedrick-Hydraulic piston rings for the next year for use as standard equipment in the 12-series and 40-series IHC engines used in the McCormick-Deering tractors. International Harvester Co. began the use of Pedrick-Hydraulic rings in these engines more than a year ago.

The Wilkening organization reports also that its Pedrick-Hydraulic piston ring installation is now used and sold by the service departments of White Motor Co., Indiana Motor Truck and Stewart Motor Corp. through their respective branches and dealer organizations.

2 Firms Pay Extras

(Continued from page 767)

cents per share on its Class A no par value stock, which is payable Jan. 2, 1937, to stockholders of record at the close of business on Dec. 5, 1936.

Kelsey-Hayes Wheel Co. has announced that it will pay on Dec. 10 the interest installments on its 15-year convertible 6 per cent debentures originally payable on July 1, 1933, Jan. 1, 1934 and July 1, 1934, but postponed in accordance with the terms of the indenture under which the debentures were issued.

Directors of Yellow Truck & Coach Manufacturing Co. have declared a dividend of $35 a share on account of accumulations on the 7 per cent cumu-

lative preferred stock. The accumulations amounted to $61.25 a share on Sept. 30, 1936. The dividend is payable Dec. 26, 1936, to stockholders of record Dec. 11, 1936.

The payment was made possible by the sale at $10 a share of 900,000 additional shares of class B stock, according to a plan recently announced. General Motors Corp., largest stockholder and a subscriber to the new stock, will receive 72.545 per cent of the total value of the preferred dividend now being paid. The dividend amounts to approximately $4,500,000 or the amount of the estimated net earnings of the Yellow Truck Co.

The board of directors of the Autocar Co. declared a dividend of 75c. a share on the company's preferred stock, payable Dec. 26 to stockholders of record as of Dec. 19. Reports disclosed steadily rising sales and profits.

GM Caravan Starts

New Tour of "Parade of Progress" Includes Pacific Coast

The new 1937 Parade of Progress Exposition, sponsored by General Motors, will leave Detroit on Dec. 1 for an extended tour of the South, Southwest, and Pacific Coast. J. M. Jerpe, director, will be in charge, assisted by Joseph P. Dever, and Harrison Warner.

The first showing of this improved "world's fair on wheels" will be made at Pensacola, Fla. The present itinerary includes engagements at Mobile, Ala.; Biloxi, Miss.; Gulfport, Miss.; and New Orleans, La.

The caravan, comprising 34 automotive units operated by a crew of 50 men, will proceed to the Gulf Coast via Ft. Wayne, Ind., Louisville, Ky., Nashville, Tenn., Birmingham and Montgomery, Ala., traversing virtually the same route as last January to Miami, Fla., for the "world premiere" of the traveling exposition.

The 1936 Parade of Progress Exposition played its last in October in Indianapolis, then returned to Detroit for changes which will make the 1937 model even more competent to tell the story of the contributions scientific research and industry are making to better the lives of the individual citizens.

In the nine months' tour just ended, this General Motors educational activity, developed under the general supervision of Charles F. Kettering, has been exhibited in 40 cities in 10 Southeastern, Middle Atlantic, and Middle Western states to over 800,000 people, over a route covering some 6000 miles.

Synthetic Rubber Now Being Made in Japan

A new artificial rubber is now being manufactured in Japan, according to a technical report recently published. The product is to be marketed under the name "Thionites" and is said to be a polymerized ethylene tetrasulphide $(CH_2CH_2S_4)N$, made from ethylene-diglycoside and sodium tetrasulphide. Its tensile strength is less than that of natural rubber but its resistance to petroleum fuels and lubricants as well as ozone is claimed to exceed that of other synthetic rubbers.

Dr. G. W. Lewis Awarded Daniel Guggenheim Medal

Dr. George W. Lewis, director of research of the National Advisory Committee for Aeronautics, was presented Dec. 4 with the Daniel Guggenheim Medal "for outstanding success in the direction of aeronautical research, and for the development of original equipment and methods."

The presentation was made at a dinner given in Dr. Lewis' honor by the Institute of the Aeronautical Sciences at the Hotel Biltmore in New York. Harry F. Guggenheim was toastmaster. Many tributes to Dr. Lewis were given by representatives of government services and of foreign governments.

The presentation of the medal was made by Major E. E. Aldrin, president of the Daniel Guggenheim Medal Fund.

The ravages of nature on metals are as destructive of profits as the armed robber who steals your possessions.

Executives of industry would do well to investigate the new "Marks Bond" process to use on metal before painting or enameling.

• • •

Your present equipment may be used. Saves time on processing. This bonding process has proven effective under many commercial tests and will give a satisfactory coating in 30 seconds. *It permits a saving on equipment space. *Saves on fuel and heating of tanks, requiring a solution of only 140 to 160 degrees. *Sludge practically eliminated. *Has passed salt spray and humidity tests. *Gives controlled etching—light or heavy. *Has been officially approved by several of Detroit's largest industrial plants.

WRITE FOR FREE DATA AND FREE TEST

Investigate and Save Money

"MARKS BOND"

Bonding Process CORPORATION

10401 NORTHLAWN AVENUE • DETROIT

Strikes Curtail Production

(Continued from page 763)

enough to permit heavier inventories to be carried by the car manufacturer.

In view of the uncertainties in the labor situation and with no assurance against other interruptions, any forecast of December production by the industry would be mere guesswork. Orders on the books of the companies warrant capacity operations, and plants unaffected by the strike certainly will continue full tilt. Even the loss of several days' output by plants affected by the Midland stoppage would not prevent the industry from equaling or exceeding the production in December last year, when 418,317 cars and trucks were built, since practically all companies are working on heavier schedules than a year ago.

There is some basis for the belief that demands will be made on other plants by the union, with the possibility of further interruptions to production. If important sources or the car makers themselves are affected, the current shortage of automobiles caused by heavy initial demand for new models could well extend throughout the winter and prevent the building up of adequate stocks for spring demand. Even without any setbacks in production, there is sufficient business on hand and in sight to keep the plants at full tilt if sufficient stocks are to be built up for the spring rush.

In the eight weeks since introduction of 1937 models, retail sales of Hudson and Terraplane cars in the U. S. have shown a gain of 32 per cent over the corresponding period last year, according to William R. Tracy, vice-president in charge of sales of Hudson Motor Car Co. Sales for each of the past seven weeks have shown gains over each preceding week, reaching a new peak in the week ended Nov. 21, when retail sales were the highest for any corresponding week in the company's history. Factory shipments, despite a slow start early in October, ran over 21,000 cars in the first eight weeks of production. Schedules which have been accelerated in recent weeks are running close to 3800 cars a week. As a result, shipments totaled more than 11,000 cars in the first three weeks of the month.

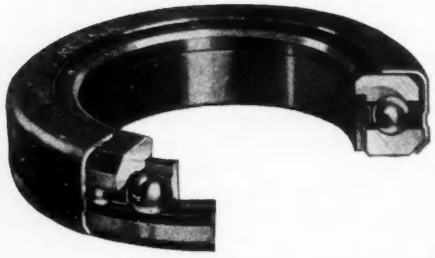
Heaviest production in the history of the Cadillac Motor Car Co. was announced for December by Nicholas Dreystadt, general manager. "Due to the record-breaking sales of 1937 Cadillacs and LaSalle V8's," Mr. Dreystadt said, "our schedule calls for 5700 cars. This volume betters the best previous month of October, 1929, when the company shipped 5160 units. When the high of 5160 was set, the LaSalle was built in a separate plant. The present Cadillac factory is thus producing more than twice as many cars as it did during peak operations of 1929."

Chevrolet production for November exceeded that of any previous November in the 25-year history of the company, totaling 112,229 units. Domestic production was 95,022; export 12,853; and Canadian 4354. Total was 3353 more cars than the 108,876 produced in November, 1935, the previous record. Unfilled orders for the new Chevrolet are running far ahead of last year, with 96,084 customers' orders still to be met. Production schedules have been stepped up to more than 6000 cars a day with plants working at capacity.

Domestic retail deliveries of the Buick Motor Co. hit an all-time record during the second 10 days of November, with 6977 cars turned over to new owners in the United States. This was the highest November period on record, according to W. F. Hufstader, vice-president and general sales manager, and compared with 5048 cars delivered during the first 10 days of the month and 4479 in the corresponding period of November a year ago.

Studebaker sales for the first 20 days of November exceeded by 15 per cent sales for the entire month of November, 1935, according to Paul G. Hoffman president of the Studebaker Corp. Sales during this period amounted to 3034 units in 1935 and 6220 this year. For the entire year to date sales were 44,464 last year and 81,670 this year.

THERE remains little chance for clutch release bearing troubles when the engineer specifies Aetna "T" Type Bearings. Eccentric thrust, the cause of wear and tear and consequent early failure of ordinary clutch release bearings simply can't take place for Aetna's patented T-shaped impregnated bronze ball retainer maintains perfect raceway alignment — always. And, too, it imprisons the original lubricant "for life" thus obviating costly machining operations for oil fittings, assuring long-life, quiet operation and the elimination of lubricant on clutch facings.



That is why this better bearing has been adopted as standard on more than 50% of all cars and trucks using clutch release bearings — a preference now fully substantiated by time-tested usage throughout millions of miles and under every conceivable condition. If you are one of the few not using them, these facts, we feel, should prompt your investigation.

AETNA
BALL BEARING MANUFACTURING CO.
4608 SCHUBERT AVE., CHICAGO, ILL. DETROIT OFFICE, 7310 WOODWARD AVE.

:SLANTS:

MUSEUM PIECE—*On view in the automobile section of the New York Museum of Science and Industry, Rockefeller Center, is one of the original electric self-starters invented 25 years ago by C. F. Kettering. The exhibit consists of a control switch, battery and combined starting motor and generator unit and was part of the first production order for use on the 1912 Cadillac. As a reminder of what went before, an old-fashioned crank lies beside the starter.*

STUDY TRUCKS—*Culver Military Academy is following the trend to mechanization of the armies of the world and has started a course in motor transport operation. Six new Dodge 1½-ton trucks, with steel bodies, similar to the type used by the U. S. Army, have been purchased. Application of the motor truck in infantry, field artillery, signal, medical and engineering corps operations will be taught.*

Maj. Albert C. Schulz

Maj. Albert C. Schulz, 61 years of age, died suddenly Nov. 25 at his home in Bridgeport, Conn. Major Schulz was one of the pioneer automobile engineers, becoming associated with Andrew L. Riker in 1902 in the development of motor cars. He served as assistant chief engineer of the Locomobile Co. until 1916, when he became chief engineer of the Mercer Motor Car Co. During the World War he served as Major in the Ordinance Corps. Leaving Mercer in 1920, he engaged in several engineering projects, and held responsible positions with Bragg & Kliesrath and Bendix. He retired from active business in 1931.

International Harvester Announces Pay Increases

The International Harvester Co. this week announced a general wage increase for all factory employes in the United States and Canada, adding more than $5,500,000 to the company's annual payrolls. "The increase," said Sydney G. McAllister, president, "at all the principal works will be 5c. an hour for men and women factory workers. At the other works, wage increases have been made with slight differences in the basis of adjustment as called for by local conditions."

Ohio State to Open Diesel School Feb. 1

A school for operators and maintenance men working on Diesel engines will be held in February at Ohio State University, it has been announced by Prof. Karl W. Stinson, department of mechanical engineering. The school, starting about Feb. 1, will last three weeks, and enrollment will be limited to a class of 50 men.

CLARK-SUNDH Heavy Duty Industrial Control

A BRAND NEW IDEA

For the complete automatic control of large Power Presses, Clark has designed and built the above illustrated group of apparatus.

This group comprises:—

(1) **The Magnetic Control Panel with all necessary contactors and relays for the control of the main drive motor and of the air-operated clutch-brake equipment which operates the one or more individual motions of the press. This panel can be mounted at any convenient location remote from the press.**

(2) **The Master Control Station, containing, in ONE unit, Push Buttons, Pilot Lights and Selector Switch for the remote control of the Main Drive, the Slide Adjustment, Inching and Emergency Stopping.**

The regularly used "Start"-"Run" buttons are separately mounted. This Master Station may be mounted on or very near the press.

(3) **ONE drum-type Limit Switch takes care of all motions where a limit of travel is required.**

This arrangement "dresses up" the Press as it deserves and makes it convenient for the operators.

The exclusive Clark Safety Anti-Repeat feature is, of course, included.

THE CLARK CONTROLLER CO.
1146 E. 152ND ST.
CLEVELAND, OHIO

Driver License Legislation Likely in Four More States

Drivers' license legislation will be made administration measures in Illinois, Oklahoma, Missouri and Tennessee at the coming legislative sessions, the Accident Prevention Conference announced this week. A representative of the Conference has just completed a series of meetings with the governors of these states and found them all whole-heartedly in favor of the legislation. Bills now being prepared with the assistance of the conference will be introduced by administration leaders at the openings of the sessions.

Similar legislation is a possibility in some of the seven other states that do not now have drivers' license laws. These seven states are Florida, Georgia, Louisiana, Mississippi, New Mexico, South Dakota, and Wyoming. The legislatures do not meet in Florida, Louisiana and Mississippi until after the other legislatures convene in January.

ICC Suspends Parts Rates

The Interstate Commerce Commission has suspended until Feb. 24 schedules proposing to reduce rates on iron and steel bumper guards and automobile parts between Decatur, Ill., and Detroit. Illustrative of the tariffs is the proposed reduction of the present less-than-carload rate of 65 cents per 100-lb. to 58 cents, any quantity.

Guests Honor Diesel

(Continued from page 763)

Edward G. Budd, president, Edward G. Budd Manufacturing Co.; Capt. Edward V. Rickenbacker, vice-president, Eastern Air Lines; C. L. Cummins, president, Cummins Engine Co.; and Thomas S. Beck, president, Crowell Publishing Co.

The talks were broadcast over the NBC blue network and were heard by 42 Caterpillar meetings in as many cities.

In the summer of 1897, at the convention of a German engineering society, a new type of heat engine was demonstrated. The engine was the Diesel and as then shown was practically the same as that now in use all over the world.

The inventor of the new engine was Rudolf Diesel, born in 1858 in Paris of Bavarian parents. His early education was in the French Capitol, followed by a course in mechanical engineering at the Munich Polytechnic. In 1893 he published a small book entitled "The Theory and Construction of a Rational Heat Motor" in which was developed the theory of the engine he was later to build. The first engines Diesel built were quite heavy, weighing 450 lb. per hp. For many years their use was restricted to heavy, slow-speed units. Today the weight per horsepower is but a fraction of the original engines, and they now power trucks, ocean vessels, tractors, trains, powerplants, pumping stations and countless other types of equipment.

Rudolf Diesel mysteriously disappeared from a channel steamer while crossing from Antwerp to Harwich only a few months before the World War, at a time when various nations were competing for the use of the Diesel engine in their navies, particularly for submarines. The fate of Dr. Diesel remains one of the unsolved mysteries of history.

American Engineering Leads, Says Alden, Back from Europe

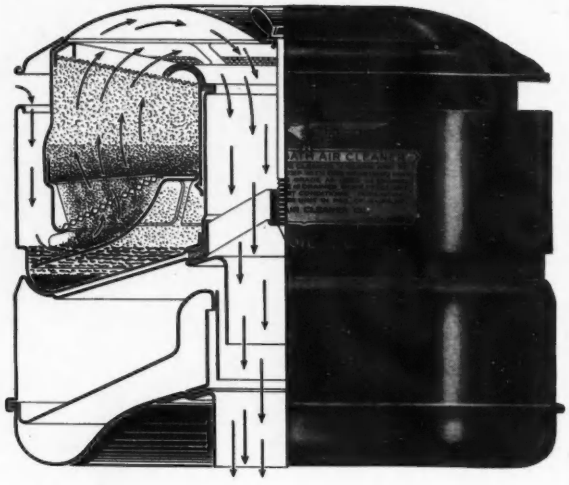
The future of the European market for American-made automobiles should continue to look bright, according to Col. H. W. Alden, chairman of the board of the Timken-Detroit Axle Co., Detroit, who has just returned from an extended European tour where he visited British and Continental automobile shows.

"As long as the American car offers more for the money, more dollar for dollar value, American manufacturers and their products have nothing to

HIGHEST AIR CLEANING EFFICIENCY

UNITED
GUARANTEED PRODUCTS.

Cut-away view of United Oil Bath Cleaner and Silencer



DUAL OIL CONTROL

Separator divides oil reservoir into two compartments of high and low turbulence areas; enables oil circulation to occur in filter element at wider range of carburetor throttle openings.

Application of stationary fan affords mechanical control of oil — an exclusive feature found only in a United Oil Bath air cleaner, a feature fully patented.

DUAL OIL CONTROL consists of application of stationary fan in filter compartment and an oil separator in oil reservoir. The fan centrifuges oil from air stream to outer wall of filter element causing quicker oil drain back and several times faster completion of oil washing cycle than in conventional type oil bath air cleaners —thus higher cleaning efficiency. Oil separator in oil reservoir provides high and low turbulence areas permits early oil wetting of filter element at small throttle openings without oil "pull-over" at maximum carburetor throttle openings. Dirt settling occurs more quickly in cleaner containing a low turbulence area—oil freer of dirt for air washing at all engine throttle openings. These two features, DUAL OIL CONTROL, provide highest cleaning efficiency.

UNITED AIR CLEANER CO.
9705 COTTAGE GROVE AVE., CHICAGO, ILL.

fear about the European market. Foreign engineers are driving American-made automobiles. When asked the reason for this, they will tell you that the American automobile offers them more for the money," said Col. Alden, twice president of the S.A.E. and a pioneer of the automotive industry.

To Col. Alden, the outstanding innovation in 1937 foreign cars is the Cotal electro magnetic transmission, a French development, which is appearing on eight foreign-made cars. It is similar to the electric-mechanical gear selector used in America, but the Cotal system is entirely electric.

Interesting is the trend toward use of the trolley bus in European cities and in London. The trolley bus, which has been introduced in cities of this country recently, is being used almost exclusively in London for city and suburban transportation. "One can go nearly everywhere in the London suburban area on the trolley bus," said Col. Alden. "Paris, too, is adapting this type of transportation for suburbs. The double-deck type is used in London while Paris prefers the ordinary bus type."

Diesel engines have not been placed in passenger cars of foreign make. Most commercial vehicles and trucks, however, are powered by Diesel engines in Europe today. There has been no trend toward using this type of power for passenger or pleasure cars.

Speaking of the European market for American automobile parts manufacturers, Col. Alden said, "The market is not a closed door by any means, in spite of the 'buy-at-home' movement that is prevalent throughout the world.

Ford Assembly Plant at Atlanta to Reopen

The Atlanta assembly plant of the Ford Motor Co. is to be reopened to handle increasing business in the Southeast. It has not been operated as an assembly plant since the latter part of 1932. When operating at capacity it produced about 150 units daily and employed approximately 1000 workers. E. D. Bottoms, branch manager, has been advised that experts will arrive from Detroit to supervise the installation of some new machinery.

Mauri Rose Named National Champion

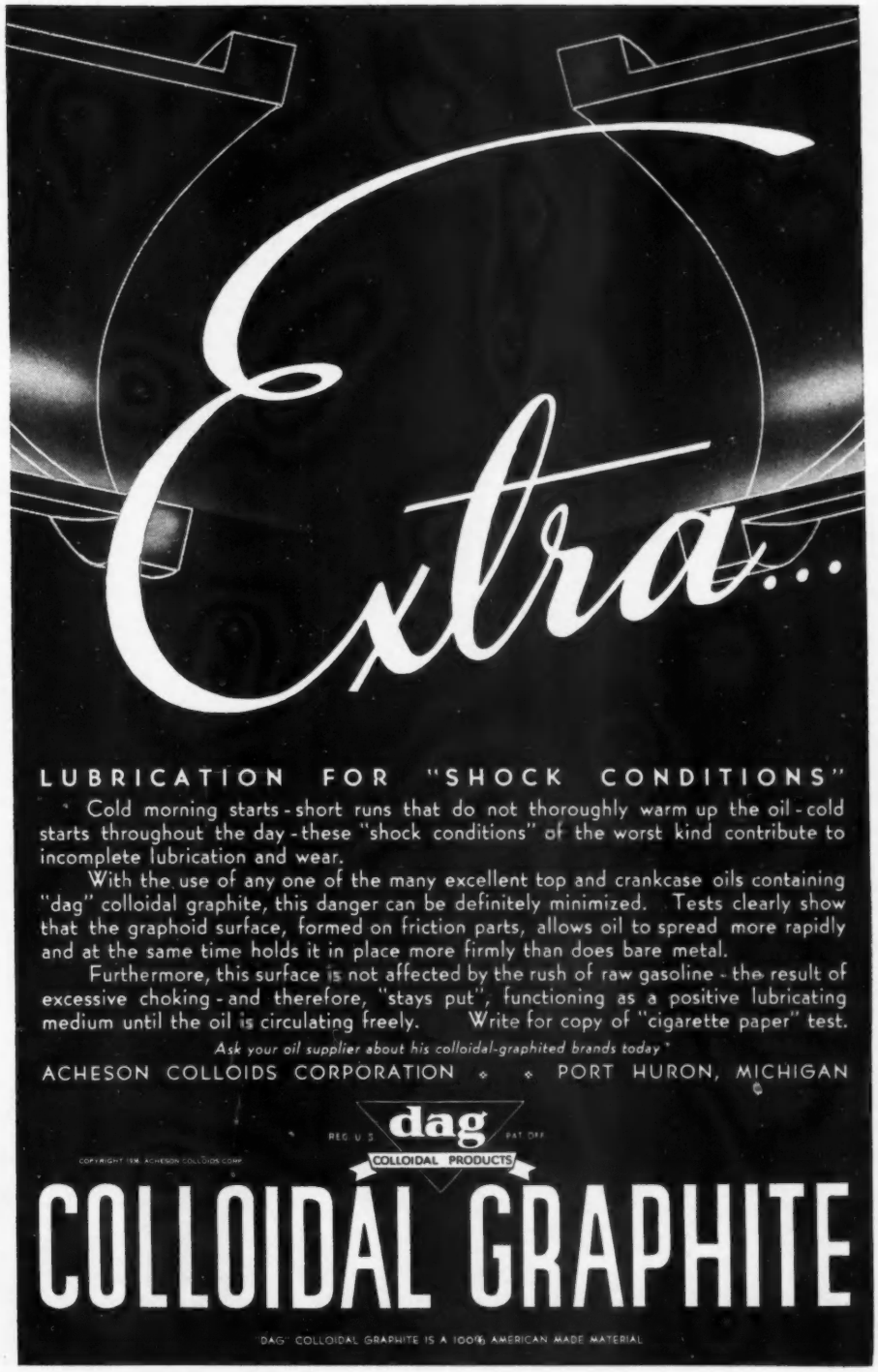
Mauri Rose, the first American driver to finish in the inaugural George Vanderbilt Cup contest at the Roosevelt Raceway Oct. 12, has been awarded the national championship title for 1936 by the Contest Board of the American Automobile Association. In second place is Lou Meyer, this year's Indianapolis winner, who is 21 points short of taking his fourth national championship. Third honors go to Ted Horn, who finished second at Indianapolis this year.

Of the 35 drivers on the 1936 rating, eight Europeans are listed as a result of their performance at Roosevelt Raceway. The first of these is Tazio Nuvolari, of Italy, who gained enough points in his Long Island victory to be placed fifth; seventh on the list is Jean Wimille, of France, who finished second at Roosevelt; ninth is Count Brivio, of Italy; 13th, Raymond Sommer, of France; 15th, Pat Fairfield, of England; 20th, Count Trossi, of Italy; 22nd, Philippe Etancelin, of France; and 29th, Fred McEvoy, of France.

In addition to being the first American to finish at Roosevelt Raceway, Rose was fourth in the 500-Mile International Sweepstakes at Indianapolis; he won the 100-mile National Championship event at the New York State Fair, Syracuse, Sept. 16; and he was sixth in the century title race at Good Time Track, Goshen, N. Y.

Perfect Circle Extra Dividend

An extra dividend of 25 cents a share on the 162,500 shares of common stock has just been declared by the Perfect Circle Co. This extra dividend, the second one declared in 1936, is payable Dec. 22, 1936, to all stockholders of record Dec. 11, 1936.


Extra...
LUBRICATION FOR "SHOCK CONDITIONS"
Cold morning starts - short runs that do not thoroughly warm up the oil - cold starts throughout the day - these "shock conditions" of the worst kind contribute to incomplete lubrication and wear.
With the use of any one of the many excellent top and crankcase oils containing "dag" colloidal graphite, this danger can be definitely minimized. Tests clearly show that the graphoid surface, formed on friction parts, allows oil to spread more rapidly and at the same time holds it in place more firmly than does bare metal.
Furthermore, this surface is not affected by the rush of raw gasoline - the result of excessive choking - and therefore, "stays put", functioning as a positive lubricating medium until the oil is circulating freely. Write for copy of "cigarette paper" test.
Ask your oil supplier about his colloidal-graphited brands today
ACHESON COLLOIDS CORPORATION PORT HURON, MICHIGAN
dag
COLLOIDAL PRODUCTS
COLLOIDAL GRAPHITE
"DAG" COLLOIDAL GRAPHITE IS A 100% AMERICAN MADE MATERIAL

Strike Halts Chrysler

(Continued from page 763)

P. Turner, divisional manager of Midland; Grover Higgins of Cleveland, attorney for the company; John Anderson, UAW organizer; and Adolph Germer, representative of the Committee for Industrial Organization, participated in the conference.

The Midland strike climaxed several weeks of negotiation. The management had agreed to demands of union recognition and a 45-hour week, with an eight-hour day and time and a half for overtime, but had refused to grant the wage increases asked by the union. Partial increases were granted except in certain departments but the workers insisted that all be granted raises. The matter of changing piecework rates to cut hourly earnings is also involved. Demands are for an average increase of 10 cents an hour.

The conference in which government conciliators participated broke off Wednesday, Dec. 2.

Canadian Retail Financing Gains

Motor vehicles financed in Canada during October, showed an increase of 37 per cent in volume and 36 per cent in value of financing over October last year. Vehicles financed during October totaled 8656 and the amount of financing was $3,222,545 compared with 6323 at $2,363,714 a year ago. New vehicles financed numbered 2060 at $1,519,272 and used cars 6596 at $1,703,273.

Borg-Warner Quarterly Dividend Raised to $1

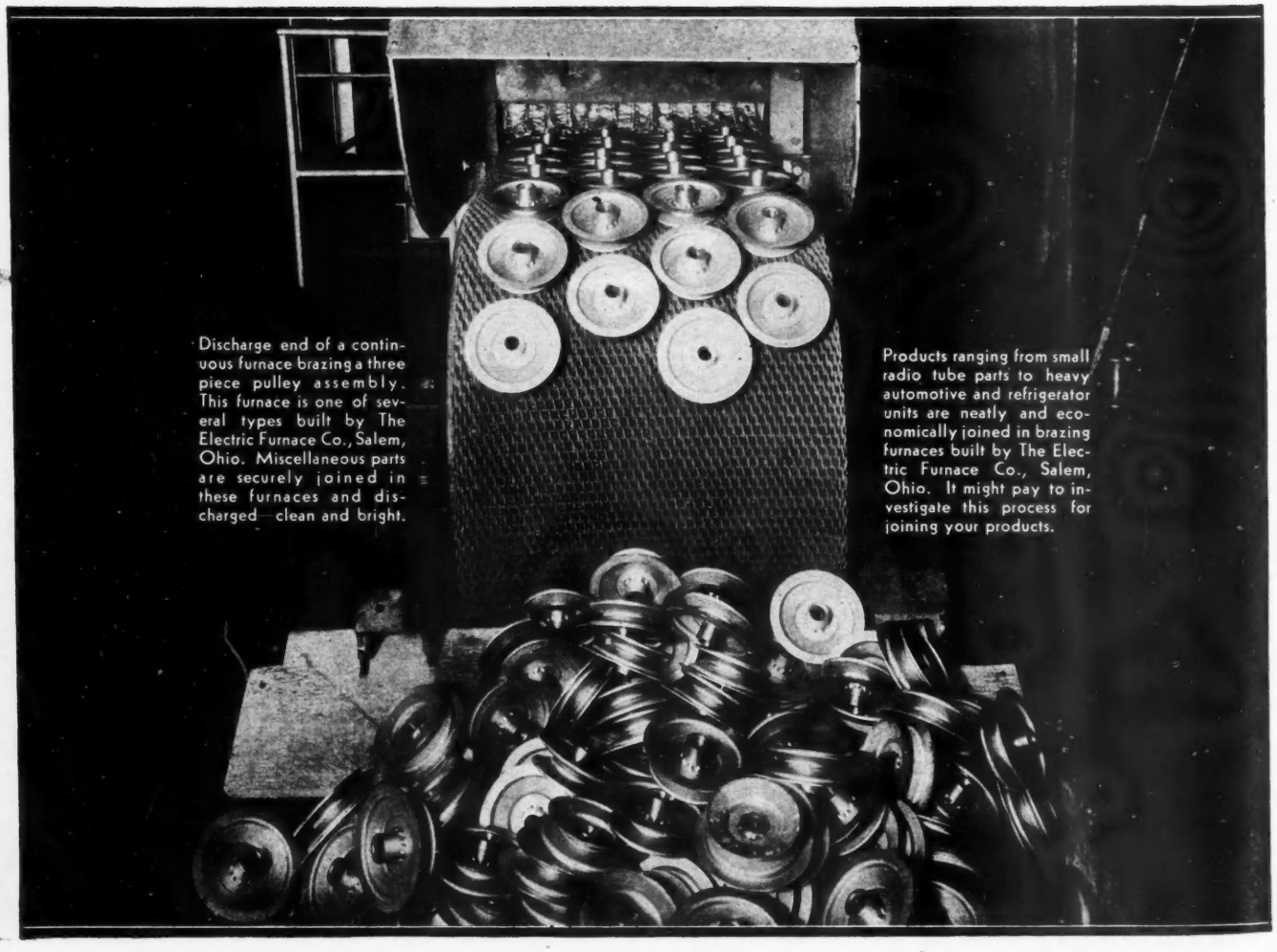
The directors of Borg-Warner Corp. have declared a regular quarterly dividend of $1 per share on the common stock, payable Dec. 21, 1936, to stockholders of record Dec. 4, 1936, an increase of 25 cents per share in the regular quarterly dividend rate. The regular quarterly dividend of $1.75 per share on the preferred stock was also declared, payable Jan. 2, 1937, to stockholders of record Dec. 15, 1936.

The directors voted to call all of the remaining outstanding preferred stock, 13,800 shares, for redemption on Feb. 1, 1937. The directors further indicated their intention of submitting to the stockholders at the next annual meeting in March, 1937, a recommendation to reduce the par value of each common share from $10 to $5 and to issue two shares of the lower par value stock for each present share outstanding.

Edwards Asks 77-B Reorganization

Cash Shortage Causes South Bend Firm to Abandon Trailer Coach Plans; Will Continue Other Lines

The Edwards Iron Works, Inc., South Bend, engaged since 1920 in the manufacture of truck equipment, cabs and bodies, has filed a petition for financial reorganization before Federal Judge Thomas W. Slick in United States district court in Hammond, Ind. At the same time W. Howard Edwards, president of the company, announced the abandonment of plans for the large-scale production of trailer coaches because of unexpected delays and expense involved in the enterprise. The Home-Mobile plant has been closed. Judge Slick has appointed Mr. Edwards and F. W. Van Antwerp, president of the First National Bank & Trust Co., South Bend, as temporary trustees in charge


Discharge end of a continuous furnace brazing a three piece pulley assembly. This furnace is one of several types built by The Electric Furnace Co., Salem, Ohio. Miscellaneous parts are securely joined in these furnaces and discharged clean and bright.
Products ranging from small radio tube parts to heavy automotive and refrigerator units are neatly and economically joined in brazing furnaces built by The Electric Furnace Co., Salem, Ohio. It might pay to investigate this process for joining your products.

of operations, and fixed Dec. 19 as the date for hearing on the petition.

Assets of the Edwards Iron Works are listed at $612,327.37 and current liabilities at $172,479.22. William A. Bertsch, South Bend attorney, who filed the petition under section 77-B of the new Federal corporate reorganization act, explained that the action was deemed advisable because of the company's limited cash position. Reorganization of the firm's capital structure will permit payment of its obligations under the most favorable terms.

Although the Home-Mobile division of the company will be discontinued, the reorganization is not expected to affect the operation of the main plant. The concern was organized 16 years ago with a capital of $8,000. Average daily employment in the iron works has been above 100 persons for the last two years.

Mr. Edwards, in commenting on the action, said: "Due to costly delays which we were unable to control, we have found it advisable to discontinue the manufacture of house trailers. This petition has been filed to insure fair treatment to all creditors. It is our intention to continue the principal business of the Edwards Iron Works, the manufacture of semi-trailers for trucks, for jobbing of iron and steel, and the steel fabrication and maintenance work which has been profitable over a long period."

The establishment of the new Home-Mobile division was announced Oct. 13, and approximately 60 persons were employed to produce the first models which were displayed at automobile shows.

Wants Federal Control

(Continued from page 764)

legislation similar to the O'Mahoney bill. While Borah always strongly opposed the NRA and apparently is prepared to do so again if efforts are made to revive it, he conceded that the Federal licensing legislation might include one of the purposes of NRA by providing for regulation of wages and hours.

The November, 1936, issue of **California Highways and Public Works**, official journal of the state department of public works, is a special San Francisco-Oakland Bay Bridge number. A number of articles describe the new bridge and its building, and it is full of striking photographs of the bridge and its approaches.

Issued in the interest of users of die castings, **"Supplement to a Visual Report of Progress in Zinc Alloy Die Castings"** is replete with examples and new ideas. It is issued by the New Jersey Zinc Co.*

A small handbook, suitable for a loose-leaf binder, has been issued by the New Jersey Zinc Co., entitled **"Zinc Metals and Alloys."** It gives in concise form complete information on all zinc metal products except rolled zinc.*

A new catalog of **material handling equipment** has been issued by Gifford-Wood Co., Hudson, N. Y. The book contains, in addition to detailed descriptions of equipment, tables and drawings which should prove valuable in planning and designing new or modernizing old material handling plants.

Madison-Kipp Corp., Madison, Wis., has brought out a new mailing folder which covers their principal products.*

A booklet, illustrating the **industrial applications of Micarta,** has recently been announced by the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.*

American Dustube **Dust Control** is the title of the new 24-page data book, No. 22, issued by the American Foundry Equipment Co., Mishawaka, Ind.*

*Available through AUTOMOTIVE INDUSTRIES.

Auto-Lite to Pay 60-Cent Dividend, $800,000 Bonus

A bonus of $800,000 was announced for employes of the Electric Auto-Lite Co. It will affect about 5000 in Toledo and 15,399 in all plants of the company. One week's wages will be distributed to all workers on payrolls Sept. 1, 1936, and a vacation of one week with pay will be granted next summer.

Directors of the company, meeting Dec. 2, declared a dividend of 60c. on the common stock, payable Dec. 21 to stockholders of record Dec. 14. On Oct. 15 last a similar amount was disbursed.

DERMA-SAN
DISINFECTANT

Prevent Oil Dermatitis with **DERMA-SAN!**

YOUR MEN do better work when you sterilize cutting lubricants with Derma-San. For Derma-San keeps oil dermatitis out of your plant. By protecting your workers against this serious skin disease, it saves compensation and medical costs. By eliminating oil infections, it increases efficiency and production. Guard your men with Derma-San. Add 1 pint of Derma-San to 35 gallons of cutting lubricant, and kill pus-forming germs before they attack your workers.

Derma-San is ideal for all general plant sanitation.

The HUNTINGTON LABORATORIES Inc.
DENVER HUNTINGTON, INDIANA TORONTO

French Aviation Show

(Continued from page 791)

factured by Mikouline and stated to develop 1250 hp. at 2150 r.p.m. There is nothing outstanding in the design. Each bank of six cylinders is a light-alloy casting with cylinder barrels screwed in, two overhead camshafts, and a centrifugal blower delivering air to the three carburetors for each bank. The variable-pitch propeller is geared down through spur pinions.

Lorraine has produced a new 12-cylinder water-cooled job of 1830 cu. in. developing 810 hp., and boosting to 1100 with special fuel. One of the features is a dual centrifugal blower giving a circular track to the mixture for each bank of cylinders. It is claimed that 70 hp. have been added to the engine by this method of induction. The engine has a planetary reducing gear with a ratio of 11 to 17 and weighs 1100 lb. empty.

There are only two Diesel engines in the show. One is the German Junkers, built in France by the Compagnie Lilloise des Moteurs (a subsidiary of Peugeot), and the other is the production of Louis Coatalen. The Junkers is a two-stroke, two-crankshaft, opposed piston job, extensively used in Germany, but apparently not yet in production in France, although it has undergone the official French 50-hour tests.

Coatalen's engine is an entirely new job. It is a 12-cylinder V of 150 by 170-mm. bore and stroke (2196 cu. in.), and is said to develop 550 hp. at 2000 r.p.m. and to weigh 1210 lb. The cylinders are an alloy casting with screwed-in nitralloy barrels, the head being a part of the casting and having bronze seats for the four valves per cylinder. There are two overhead camshafts, driven in the normal manner by bevel gearing from the rear. The propeller is geared down in the ratio of 3 to 2, giving 1350 r.p.m. at normal engine speed. A centrifugal blower is mounted on the rear end of the crankshaft to reestablish the power output at 13,000 ft. altitude.

The feature of the Coatalen engine is the "common-rail" method of direct injection. At the rear of the engine, just above the blower, there are two four-barrel pressure pumps, either one of which is sufficient to feed the engine. These maintain the fuel under constant pressure in a feed pipe inside the camshaft housing. The injection is varied by means of longitudinal displacement of the admission camshafts, on which there are conical cams giving from 10 to 60 deg. injection. The injection takes place in the center of the combustion chamber. It is stated that the engine will throttle down to 150 r.p.m. and that it is entirely free from smoke through its entire speed range.

The fuel line is put under pressure in the first place by a separate electrically operated pump. Compressed air is used for starting, the pump being mounted across the engine, just below the propeller hub.

Among the auxiliary groups for use on big planes is a 115-lb. unit shown by Potez comprising a twin-cylinder air-cooled four-stroke engine operating four distinct accessories which can be linked up as desired by means of synchro-mesh gears, viz., an electric generator capable of delivering 1500 watts at 24 volts for 15 minutes; a fuel-mixture pump for engine starting; a compressed-air pump and a gasoline pump capable of raising 1300 gals. per hour to a height of 80 in., one-half of this under suction.

A feature which is new this year is the elastic mounting of engines through

In Mechanics Roller Bearing Universal Joints end thrusts are carried by the large, hardened, ground, and amply lubricated journal ends. This is accomplished by fitting the ends of the cross snugly to the bottom of the journal bearings, a construction which relieves the shoulders of the thrust loads, reduces wear, materially increases the life of the joint. Long life, perfect balance and ease of assembly are but a few of the reasons why Mechanics Universal Joints are used on leading passenger cars, trucks and busses. Investigate.

MECHANICS UNIVERSAL JOINT DIVISION
Borg-Warner Corp. 1301 18th AVE., ROCKFORD, ILLINOIS

rubber blocks. In this respect the aviation industry has profited by experience with automobile-engine mountings. There are no examples of direct fuel injection on gasoline engines, although according to engineers experiments are being carried out by several firms.

New GM Proving Ground Being Built at Phoenix

A new base for automotive testing operations supplementing those of General Motors proving ground at Milford, Mich., will be established at Phoenix, Ariz., it was announced by General Motors officials at Detroit.

The base, to be known as the Argonaut proving ground, operated by Argonaut Realty Corp., a subsidiary of General Motors, will cost approximately $100,000 and will be completed this month, according to present plans. A contract has been let to the Austin Co. of Los Angeles. The two-story plant, located on a six-acre plot at Twentieth Avenue and Roosevelt Road in Phoenix will house general offices, laboratories and garage facilities. It will contain 11,218 sq. ft. of floor space and be of glass block and steel construction.

For many years General Motors engineers have been taking experimental cars into the Southwest for certain testing operations impossible in Michigan because of climatic and geographic conditions, just as they try out proposed new cars at Regina, Saskatchewan, Canada, in 50 below temperatures during the winter. The new base for these operations in the Southwest is being established at Phoenix because of its convenient location to air, rail and highway transportation, hotels and the particular terrain and atmospheric conditions which the engineers desire.

Hein-Werner to Build Machine Shop Addition

Hein-Werner Motor Parts Co., Waukesha, Wis., is about to break ground for a machine shop addition estimated to cost $30,000 to meet increased demand which so far this year represents a 75 per cent gain over last year. The firm was founded in Milwaukee in 1919 to manufacture Ford replacement parts, principally water pumps. It moved to Waukesha in 1929 and besides making original and replacement pumps it has been manufacturing hydraulic jacks since 1931.

Canadian Tariff Hearing Dec. 15

The hearing by the Canadian Tariff Board at Ottawa, Ont., on automobiles, scheduled for Dec. 1, has been postponed until Dec. 15. On that day the board will hear an appeal entered by the Canadian Automobile Chamber of Commerce from a customs ruling relating to materials exempt from sales tax.

MESA Elects New Officers; Union Claims 11,123 Members

Results of the national election of the Mechanics Educational Society of America showed election of the following officers: George Becker of Toledo, president; Gerald Francis of Detroit, vice-president; Matthew Smith of Detroit, secretary; William Sheehan of Detroit, treasurer; and as trustees, Daniel Swin of Detroit, William Godie of Toledo, Carl Grosse of Chicago, A. D. Armstrong of Toledo and Lawrence Spears of Detroit.

According to Mr. Smith, the MESA has 11,123 paid members of whom 40 per cent are tool and die workers and 60 per cent production men.

Levin Faust

Levin Faust, 73, one of the founders of the Mechanics Universal Joint Co., the Rockford Drop Forge Co., Rockford Machine Tool Co., National Lock Co., and the Sundstrand Adding Machine Co. and affiliated companies, of Rockford, Ill., died Nov. 18. He was a director of most of these companies at the time of his death. He was the inventor of many devices, including universal joints and locks.

METAL SPHERES
WITH
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Strom Steel Balls possess that extra measure of quality by means of which the ultimate in ball bearing performance is achieved.

This special lapping practice is exclusive with Strom.

Physical soundness — correct hardness — size accuracy and sphericity are guaranteed in all Strom Balls.

Other types of balls — STAINLESS STEEL — MONEL — BRASS & BRONZE — are also available in all standard sizes. Write for full details.

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1850 So. 54th Avenue, Cicero, Ill.
The largest independent and exclusive Metal Ball Manufacturer

FTC Attacks 6% Claims

(Continued from page 765)

Mich., and Packard Motor Car Co., Detroit.

Financing companies named as respondents in the complaints are:

General Motors Acceptance Corp., New York City, joined with the General Motors group; Commercial Credit Co., Baltimore, joined with Chrysler Corp. and its subsidiaries; Universal Credit Corp., Detroit, with Ford Motor Co., and Commercial Investment Trust Corp., New York City, with Graham-Paige Motors Corp. and Hudson Motor Car Co.

In advertising their methods of financing the purchase of motor vehicles, the respondent corporations allegedly feature in their advertisements that they will sell their cars on an annual six per cent time-payment plan. According to the complaints, the financing plans employed actually involve a six per cent rate charged on the full amount of the account from the date it begins until it is closed, regardless of the fact that the account is amortized in equal monthly payments. For that reason, the complaints charge, the financing plans used involve interest payments actually about 100 per cent greater than the six per cent interest rate, or approximately 12 per cent.

The acts and practices of the respondent corporations, as set out in the complaints, are "all to the prejudice of the public and respondents' competitors" and "constitute unfair methods of competition in commerce within the intent and meaning of Sec. 5 of the Federal Trade Commission Act.

Respondents are allowed 20 days from service of the complaints in which to file their answers to the charges contained therein.

A joint statement issued Dec. 3 by Duane R. Dills, general counsel for Commercial Credit Co., and P. W. Haberman, general counsel for Commercial Investment Trust and Universal Credit Company, referred to the FTC complaint.

"The first indication of this complaint," the statement said, "came early last fall when the commission submitted to the various manufacturers and finance companies proposed stipulations prepared by the commission to cease and desist from the questioned type of advertising which is no longer employed. The issue was a technical matter of the phraseology employed in the advertising and, whether it might reasonably be subject to misunderstanding, the element of intent to mislead the public was absent. A form of stipulation such as practically all of the respondents were willing to enter into was submitted by them but the commission only recently declined to accept it.

"The adoption by the respondents of the so-called 6 per cent plan was not prompted by any intent to deceive the consumer.

"For years the motor manufacturers have sought in every possible way to reduce the price of their products and the promulgation and advertising of the so-called 6 per cent plan was in harmony with this purpose. The national finance companies for years had endeavored to educate the public into an appreciation of the factors it should consider in making instalment purchases. It was not until it became possible to promulgate the 6 per cent plan that there was presented to the purchasing public a formula which was easily understood and applied and which, by a simple method of multiplication, enabled the prospective purchaser to calculate the total price paid by him in order to be in a position to compare competitive prices. No one was damaged by the form of advertising as it was pointed out that the 6 per cent was not advertised as an interest charge but was a flat charge on the balance to be paid. The objection of the commission related to matters of form and not of substance. The respondents endeavored to cooperate with the commission but without success. Accordingly they will be obliged to vindicate the ethics of their position even though the basis for the complaints made by the commission has disappeared."

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